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Understanding parent influences on youth decisions to enter agricultural grain storage facilities

Kayla Walls
Iowa State University

Understanding parent influences on youth decisions to enter agricultural grain storage facilities

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Kayla Nicole Walls

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Steven A. Freeman
Michael S. Retallick

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

This thesis is dedicated to my parents, Kerry and Heidi Walls, whose endless support, encouragement, and love has not only made this project possible, but also brought it to completion.

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ABSTRACT

Entrapment and engulfment inside agricultural grain bins has historically resulted in abundant injuries and fatalities. A primary population affected by grain entrapment and engulfment are youth under 21 years old, many of whom were working on their family farms at the time of the incident. Family farms are exempt from the Hazardous Occupations Orders for Agriculture, allowing youth under 16 years old to complete any farm task if the farm owner or operator is their parent. Therefore, youth are permitted to work inside and around grain storage facilities at any age.

Parents often supervise their children as they complete agricultural work. The researcher hypothesized that the approach parents take to supervising hazardous tasks may play a role in youth safety outcomes on family farms. The researcher also expected there to be gendered differences in youth decision-making patterns regarding grain storage facilities. Understanding why youth enter hazardous situations and end up entrapped or engulfed in grain was the primary goal of the research.

Little is known about youth decision-making regarding hazardous tasks in agriculture. To determine the factors influencing youth decision-making, a scenario-based survey instrument was created that included three scenarios involving grain bins. Participants were limited to students at one Midwestern land-grant university who had grain bin experience as youth. Participants were presented with the scenarios and had to choose a course of action before ranking the factors that affected their decision-making. Afterward, several participants were interviewed. The researcher analyzed all survey and interview data to determine which factors played the most critical role in youth decisions to enter agricultural grain bins.

While further research should be conducted in this topic area, the results of this study conclude that youth know the hazards and honor their personal safety. Youth credited their parents for being their primary teacher about farm safety and trusted their parents in the assignment of appropriate farm tasks. Despite the results, some participants may still choose to make hazardous decisions regarding grain bins. However, this study exemplified youths' optimistic attitude toward safety on family farms.

CHAPTER 1. GENERAL INTRODUCTION

The agriculture industry is unique in that work and home are often the same place. There are approximately 2.03 million farms in the United States (USDA National Agricultural Statistics Service, 2019), which 23,883,000 youth visited in 2014 alone (NIOSH, 2018). Aside from visiting farms, youth have various roles within the agricultural industry. Historically, youth have been heavily involved with their family farming operations (Effland, 2005). Nearly 893,000 youth live on a farm, and over half of those youth participate in work on their farm (NIOSH, 2018). Furthermore, agriculture is a substantial employer of non-residential farm youth. In 2014, 265,600 youth did not live or grow up on a farm but were hired to work on a farming operation (NIOSH, 2018).

With the considerable number of youth workers in agriculture, there are also many injuries and fatalities among this population. Approximately 33 children are injured in an agriculture-related incident each day (Perritt et al., 2017). Moreover, agriculture incidents average one child fatality every three days (NIOSH, 2016). Compared to all other industries, the injury and fatality rate of youth workers in agriculture far exceed the average rates. Between 1992 and 2002, the fatality rate of young agricultural workers was 3.6 times the rate of young workers across all industries and 2.9 times the rate of all workers across all industries (Hard & Myers, 2006). Nearly 48% of all fatal injuries to young workers occurred in the agricultural industry from 2001 to 2015 (NIOSH, 2019). Despite increased intervention efforts, these statistics are not improving with time. Since 2009, the fatality rate of youth workers in agriculture has exceeded that of all other industries combined (NIOSH, 2019). Although several injury agents contribute to these incident totals, agricultural confined spaces are of particular interest in this study.

Historically, agricultural confined spaces have significantly contributed to work-related injuries and fatalities among adult and youth workers (Riedel & Field, 2013). The problem continues to exist today. The Purdue University Agricultural Safety and Health Program has been documenting grain entrapment and engulfment cases since 1978 and has amassed over one thousand total reports (Issa et al., 2016). Throughout the database's forty-year history, an average of one in five reported grain entrapment and engulfment cases involved youth under 21 years old (Riedel & Field, 2013). The database shows that over three-fourths of youth grain entrapment and engulfment cases have resulted in fatalities, suggesting that non-fatal youth grain entrapment and engulfment cases are underreported (Issa et al., 2016). The question remains as to why youth are becoming entrapped and engulfed in grain, and furthermore, why youth are entering grain bins in the first place.

Some argue that the nature of farm work is inappropriate for youth (Effland, 2005). Consequently, the federal government created child labor laws to help minimize the effects of work on the health and welfare of young employees (Miller, 2012). The Hazardous Occupations Orders for Agriculture contains a list of eleven hazardous tasks that are considered too dangerous for youth under 16 years old to complete. According to the orders, working inside an agricultural confined space is considered a hazardous task. However, there are exemptions to this federal rule. Children who work on farms owned or operated by their parents can partake in any agricultural task (U.S. Department of Labor, 2007).

Parents regularly serve as their youth's supervisors as they complete agricultural work (Jinnah & Stoneman, 2016). To determine their youths' responsibility levels on the farm, parents often use the youth's age and gender (Stoneman & Jinnah, 2016). For example, an older youth may be assigned more complex farm tasks, and boys may be permitted to complete specific tasks

at younger ages than girls. However, research shows that the number of youth farm injuries increases with age, and boys are twice as likely to become injured than girls (Rivara, 1997).

Youth injuries on the farm result from being exposed to the hazard (Elliot et al., 2018). Research by DeWitt et al. (2015) has shown that increased time completing farm work is associated with the occurrence of injury. Therefore, the younger that children are brought into the farm environment, the longer they are exposed, and their injury rates are higher. Per Piaget's Stage Theory of Cognitive Development, youth are incapable of reasoning and abstract thinking until they reach the Formal Operational Stage from 12 to 18 years old (Huitt & Hummel, 2003). Youth in agriculture often perform farm tasks before reaching this threshold and are likely completing chores that are inappropriate for their age and cognitive development. Research has suggested a need for parental guidelines that outline age-appropriate agricultural tasks for farm youth (Park et al., 2010).

Previous research studied youth safety behaviors on the farm from the parents' point of view. Nilsson (2016) determined parents' attitudes toward their youth growing up and working on farms. Elliot et al. (2018) analyzed the parents' perceived risks and benefits of bringing their children to the farm environment. Research by Stoneman and Jinnah (2016) distinguished farm parents' safety perceptions between their sons and daughters. In terms of parental influence on youth safety, Jinnah and Stoneman (2016) researched the effects of different parenting styles on farm youth safety behavior.

Researchers have also studied youth risk-taking and experimentation at length. Lasenby-Lessard et al. (2013) examined the risk-taking of youth with repeated actions and experiences. Differences in risk-taking by gender have also been studied, as exampled by Killgore et al. (2010). Additionally, research has been published related to adult worker decision-making in

agricultural safety scenarios. Mosher et al. (2014) examined adult grain elevator workers' decision-making and how safety, productivity, supervisor's opinion, and peer pressure affected their choices. However, research has yet to be conducted on youth workers' decision-making in agricultural settings, specifically regarding grain bin safety, and the factors that affect this decision-making.

The factors influencing youth involvement with grain storage facility tasks are unclear. Adapted from a decision-making study by Mosher et al. (2014), the factors to be analyzed in this study are personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. The researcher hypothesizes that parental authority and pressure has a strong influence on youth decisions to enter agricultural grain storage facilities. Previous research has shown a reduction in worker risk-taking when the supervisor clearly advocates against taking work-related risks (Westaby & Lowe, 2005). Correspondingly, there is a correlation between supervisors who promote productivity instead of safety and unsafe behaviors by their workers (Barling & Hutchinson, 2000). Therefore, parents should prioritize and explicitly communicate safety information while working with their youth on the farm.

The researcher also hypothesized that there would be gendered differences in youth decision-making regarding grain storage facilities. Based on research by Rivara (1997), males tend to be injured more in agricultural settings than females. These results may be associated with findings by Killgore et al. (2010), who determined that males displayed a higher risk-taking tendency than females. It was concluded that gender plays a role in risk-taking behavior (Killgore et al., 2010). Therefore, the researcher anticipated significant differences in the scenario decision-making between genders. It was expected that females would select more risk-

averse courses of action, whereas males would make selections that may have endangered them in the hypothetical scenarios.

Three research questions frame the efforts of this study:

1. Why do youth choose to make hazardous decisions regarding grain storage facilities?
2. What role does parental supervision play in youth safety-related decisions on the family farm?
3. How do the factors of personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure affect youths' decisions?

Statement of the Problem

Research has documented the risk of youth workers completing agricultural tasks, but the factors influencing young workers' decisions while completing these tasks have yet to be determined. Grain entrapment and engulfment cases in agriculture contribute to approximately 15 deaths per year (Cheng et al., 2019). One of the primary populations affected by grain entrapment and engulfment is youth under 21 years old, primarily boys ages 11-20 years old (Issa et al., 2016). Most cases occur on sites exempt from Occupational Safety and Health Administration rule, such as family farms, in the Midwestern United States (Issa et al., 2016). These family farms are also exempt from the Hazardous Occupations Orders for Agriculture when the farm owner or operator is the youth's parent (U.S. Department of Labor, 2007). Parents regularly supervise their children as they complete work on the family farm. The researcher hypothesized that the approach parents take to the supervision of hazardous tasks plays a role in youth safety outcomes on family farms, and that there are gendered differences in the risk-taking propensity of farm youth. Understanding why youth enter hazardous situations and end up entrapped or engulfed in grain is the primary goal of the research.

Purpose and Objectives

This study aimed to determine the factors that influence youth entry inside agricultural grain storage facilities. The factors considered were personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. The researcher followed four objectives to complete this study:

1. Identify the reasoning for youth grain bin entry.
2. Utilize a scenario-based survey instrument and qualitative interviews to determine which course of action participants would take if presented with real grain bin-related situations.
3. Determine which factors contributed to participants' decision-making in each scenario.
4. Analyze the demographic differences in participant responses.

Need for the Study

Agriculture consistently ranks among the most hazardous industries for youth workers. Per the exemptions to federal regulations, youth who work on farms owned or operated by their parents can assist in potentially hazardous farm tasks. Youth often participate in tasks that are inappropriate for their age and level of cognitive development, including working inside agricultural confined spaces. Youth entrapment and engulfment inside grain bins contribute to numerous injuries and fatalities each year, yet the reasoning behind youth entry into grain bins is unclear. There is a need to look through the youth perspective when analyzing decision-making and risk-taking propensity concerning agricultural grain bins. This study seeks to determine how specific uncontrollable factors and personal pressures play a role in youth safety-related decisions on family farms. The factors analyzed in this study include personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure.

Implications

This study will help determine the reasoning behind youth entry into agricultural grain bins. It also analyzes how the factors of personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure affect youths' decisions in these situations. If researchers can understand why youth enter grain bins and choose to make hazardous decisions, focused efforts can prevent youth grain storage-related incidents from occurring in the future.

This research could assist agricultural safety and health professionals target educational messages toward youth and their parental supervisors to improve youth safety outcomes on family farms. Enhanced safety messages may help increase the memory retention of youth involved in potentially hazardous farm tasks, including working around grain storage facilities. Targeted messages toward parental supervisors could provide education on how to appropriately assign farm tasks and the proper techniques for supervision. These efforts could help reduce injuries and fatalities associated with youth grain entrapment and engulfment.

Definition of Terms

Confined space – An agricultural workplace that was not intended to be a regularly inhabited workstation due to the restricted entry and exit points and the potential to contain physical or toxic hazards that may affect individuals entering the space (Riedel & Field, 2013).

Grain entrapment – A partial submersion in grain where the victim's head is visible above the grain (Issa et al., 2017).

Grain engulfment – A full submersion in grain where the victim's head is not visible above the grain (Issa et al., 2017).

Organization of Thesis

Six chapters comprise this thesis: general introduction, literature review, methodology, two manuscripts as results, and general conclusion. The general introduction presented the problem statement, need for the study, purpose and objectives, implications, and relevant terms. Chapter two is a comprehensive review of the literature related to grain entrapment and engulfment, youth in agriculture, parental supervision of farm youth, and worker decision-making factors. The methodology section outlines the mixed methods used to conduct this study and recognizes the study's limitations. The first results section exposes the quantitative survey results, analysis, and implications. Chapter five reveals the follow-up qualitative outcomes of this study. Finally, the general conclusion section reports the significant findings, draws conclusions, acknowledges the study's implications, and addresses the need for additional research.

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CHAPTER 2. LITERATURE REVIEW

Given the elevated rates of worker injuries and fatalities, published research is clear that agriculture is one of the most hazardous industries (Bureau of Labor Statistics, 2018; Hendricks et al., 2018; Issa et al., 2017; Moore & Jones, 2017; Miller, 2012). In particular, agricultural confined spaces pose specific threats to those who enter them. A confined space is an agricultural workplace that was not intended to be a regularly inhabited workstation due to the restricted entry and exit points and potential physical or toxic hazards affecting those who enter the space (Riedel & Field, 2013). One type of agricultural confined space is a grain storage facility, such as a metal grain bin. Becoming entrapped or engulfed in grain is one of the common dangers of entering a grain bin. Grain entrapment is a partial submersion in grain where the victim's head remains visible above the grain (Issa et al., 2017). Grain engulfment is where the victim is fully submerged in grain and their head is not visible above the grain (Issa et al., 2017). In both grain entrapment and grain engulfment situations, the victim typically needs assistance to be removed from the grain.

Grain Entrapment and Engulfment

Cheng et al. (2019) estimated that up to 30% of grain entrapment and engulfment cases go unreported due to a lack of reporting means. Failure to report a grain entrapment or engulfment is especially common in non-fatal cases when the victim was in shallow enough grain that they could extricate themselves (Roberts et al., 2011). The Purdue Agricultural Confined Space Incident Database (PACSID) documents grain entrapment and engulfment cases in the United States. In 2018, there were 30 grain entrapment and engulfment cases logged in the PACSID, half of which resulted in a fatality (Cheng et al., 2019). Most recorded grain entrapment and engulfment cases occurred in the Midwestern United States: Iowa, Illinois,

Indiana, Minnesota, Ohio, and Nebraska (Cheng et al., 2019). This list closely aligns with the states that have the most grain storage capacity: Iowa, Illinois, Kansas, Nebraska, Texas, and Minnesota (Roberts et al., 2011). According to Riedel & Field (2013), the typical victim found in the PACSID was a 38-year-old male working at an OSHA-exempt farm in the Midwest. The victim entered a grain bin while unloading out-of-condition corn, became engulfed, and suffocated (Riedel & Field, 2013). While suffocation may have been the ultimate cause of death in most PACSID cases up to 2013 (Riedel & Field, 2013), the human body is impacted in many other ways while entrapped or engulfed in grain.

Issa et al. (2017) determined that the human body encounters environmental and physiological factors while entrapped or engulfed in grain. Environmental factors depend on the depth of entrapment or engulfment, the position of the body, friction, and the grain's pressure, weight, and temperature (Issa et al., 2017). Physiological factors pertain to the victim's age, physical condition, oxygen consumption, blood flow, and heart rate (Issa et al., 2017). Physiological factors play a role when investigating the impacts of grain entrapment and engulfment that may ultimately lead to a fatality. Published research shows that the leading cause of death in entrapment and engulfment victims was aspiration, or breathing in a foreign object (Issa et al., 2017). In grain entrapment and engulfment cases, grain such as corn, soybeans, or wheat serves as the foreign object that enters the body and blocks the airway. Asphyxiation, or suffocation due to the lack of oxygen, was the next leading cause of death (Issa et al., 2017). Grain weight and lateral pressure on the body were the subsequent leading causes of death in grain entrapment and engulfment victims (Issa et al., 2017).

Moore and Jones (2017) sought to determine the pressure that the human body encounters while entrapped or engulfed in grain. The results showed that the deeper the body is

buried in grain, the more pressure it experiences (Moore & Jones, 2017). A healthy adult male's ability to breathe would not typically be compromised while they are engulfed in grain (Moore & Jones, 2017). However, several factors may affect this point, such as the victim's age, gender, and body position in the grain (Moore & Jones, 2017). At present, research has not been conducted on the respiration ability of a child entrapped or engulfed in grain. It is evident that grain entrapment and engulfment is taxing on the body of an adult, and therefore, it is expected the effects are even harsher on youth victims.

Youth

In 2012, there were nearly 14,000 documented injuries of youth living on, working on, or visiting farms in the United States (Hendricks et al., 2018). Most injuries occurred to youth under 16 years of age (Hendricks et al., 2018). Youth are more susceptible to injury due to their smaller size, less strength, and greater surface-to-volume ratio (Arcury et al., 2015). They also lack maturity and experience as they are still developing their cognitive, skeletal, muscular, and neurological systems (Arcury et al., 2015). According to Arcury et al. (2015), this ongoing bodily development could also impact youths' vulnerability to injury.

The frequency of injuries and fatalities involving youth in agriculture has declined over recent years (Hendricks et al., 2018). However, this is not the case when considering incidents involving grain storage facilities. More than one in five recorded grain entrapment and engulfment cases involved a youth under 20 years old (Issa et al., 2016). Most of these cases resulted in a fatality (Issa et al., 2016). In 2018, there was a sharp increase in youth grain entrapment and engulfment cases, as one-third of the recorded cases involved a youth under 21 years old (Cheng et al., 2019). These statistics are concerning, as federal regulations were implemented with the intent to lessen these injuries and fatalities among youth in agriculture.

Child Labor in Agriculture Regulations

The agriculture industry has the highest fatality rate among youth workers, making it the most hazardous industry for this population (Centers for Disease Control and Prevention, 2003). The high number of fatal incidents involving youth in agriculture are of concern due to the United States Department of Labor's Hazardous Occupations Orders for Agriculture. Created in 1938 as a subset of the Fair Labor Standards Act, the orders created to minimize the impact of work on young employees' health and welfare (Miller, 2012). Today, the orders outline eleven tasks that are deemed too dangerous for youth under 16 years old to complete. One of the Hazardous Occupations Orders for Agriculture aligns with working inside grain bins. One order prevents youth under 16 years old from, "Working inside a fruit, forage, or grain storage designed to retain an oxygen-deficient or toxic atmosphere" (U.S. Department of Labor, 2007, p. 5). However, there are a few exemptions to this rule. According to the United States Department of Labor's Child Labor Bulletin 102, "These prohibitions on employment in hazardous occupations in agriculture do not apply to youths employed on farms owned or operated by their parents" (2007, p. 5).

The standards for permit-required confined spaces, 29 CFR 1910.146, and grain handling facilities, 29 CFR 1910.272, require workers to be 18 years old before they are assigned to work inside permit-required confined spaces (OSHA 1993, 2002). Therefore, agricultural businesses are not legally permitted to allow youth entry into grain bins. However, family farm facilities are exempt from these standards. Adding to the concern, over three-fourths of the fatally injured youth in agriculture were working on family farms when the incident occurred (NIOSH, 2003). Thus, exempt from the rules regarding permit-required confined spaces, youth continue to participate in risky grain storage-related tasks on their family farms.

Risk-Taking

Farm injuries are often dependent on gender and age. Rivara (1997) discovered that the number of farm-related injuries increases with age, and that boys are twice as likely to be injured than girls. The statement is consistent with a study by Killgore et al. (2010) that found males have greater risk-taking tendencies than their female counterparts. Males are more likely to seek out sensational activities with higher levels of risk (Killgore et al., 2010). Specifically, research yields that boys are two times more likely to partake in risky activities than girls (Lasenby-Lessard et al., 2013). These findings could be related to how the two genders generally evaluate risk. While boys tend to evaluate risk through touch and retrieval, girls tend to use vision (Vogel et al., 2003).

Killgore et al. (2010) used a predeveloped instrument called the Evaluation of Risks scale to test these risk-tendency theories in adults. The researchers' results supported their hypothesis that men would score higher than women in overall risk-taking propensity (Killgore et al., 2010). Per the research results, males showed a greater willingness to engage in a variety of hazardous, high-energy, and risky activities (Killgore et al., 2010). Men also had a belief that they would be unharmed by their involvement in these activities (Killgore et al., 2010). One example of a potentially hazardous, high-energy, and risky activity is removing grain from a grain bin. If males believe they will be unharmed while unloading a grain bin, they may be more apt to take risks while completing the task. Killgore et al. (2010) stated that males, including young boys, may display a poorer judgment of risk-taking than women and young girls in various situations. Therefore, young boys may take more risks than girls in situations involving grain storage facilities. Understanding this fact may help answer why there are numerous grain entrapment and engulfment incidents involving young boys under 18 years old.

Lasenby-Lessard et al. (2013) stated that youths' increased experience with a physical activity leads to more risk-taking, and not necessarily lower levels of injuries. Instead, more experience may lead to more injuries because children tend to take additional risks when they are familiar with an activity (Lasenby-Lessard et al., 2013). Furthermore, when children assess an activity as having a low level of danger, low vulnerability for injury, and believe they will not become seriously injured by partaking in the activity, they will take greater risks (Lasenby-Lessard et al., 2013). Thus, farm parents must communicate the dangers of taking risks around grain storage facilities to their youth, regardless of their exposure level. Findings by Lasenby-Lessard et al. (2013) indicated that mothers allowed their children to take more risks in activities that the youth had plenty of experience doing. If youth are continuously exposed to grain storage facility hazards, their risk-assessment will likely be lower due to their increased experience. It is also probable that they will take more risks. Parents are tasked with helping mitigate these risks because in agriculture, parents frequently serve as their child's primary supervisor while the youth completes farm work (Summers et al., 2017; Jinnah & Stoneman, 2016).

Parent and Youth Interface in Agriculture

Farming is often a family affair – parents want to spend time with their children on the farm and involve them in work. They are proud when their children decide that they are interested in participating in farm activities and have a certain level of responsibility in helping the farm operate (Nilsson, 2016). However, youth injuries can be caused simply by being present on the farm, even while youth are not working. Farm injuries result from being exposed to the hazard (Elliot et al., 2018). Many youths become injured because the farmstead is both their home and their play space. Nearly 60% of youth incidents on farms occur while youth are playing (Norwegian Farmers' Association, 2000). The lack of distinction between where play stops and where work begins may be difficult for parent supervisors to monitor. In half of youth

injury cases, the injured youth was under the surveillance of an adult performing farm work near the child (Wright et al., 2013). This fact debunks a common myth believed by parents that keeping their children nearby will keep them safer (Summers et al., 2017).

Farm parents decide how to engage their youth in farm work based on the perceived benefits and risks. Some parents continue to involve their youth in the farm operation because, through their parental perspective, they believe the benefits outweigh the risks (Elliot et al., 2018). Parents think that it is their responsibility to make the farm environment as safe as possible for their youth, but they feel unable to protect them in every way (Nilsson, 2016). They also agree with the importance of practicing safety themselves to serve as a good role model for their children (Nilsson, 2016). Youth often imitate the safety behaviors they see from their superiors (Darragh et al., 1998). Based on research by Jinnah and Stoneman (2016), there is a positive correlation between high levels of unsafe farm behaviors of fathers and their children, as youth often mimic their fathers. Therefore, it is essential that fathers teach their youth about farm safety and practice proper safety behaviors themselves.

Conversations about farm safety are often overlooked because some parents assume that their youth know the hazards (Nilsson, 2016). Likewise, parents frequently think that safety is "common sense" (Summers et al., 2017), not recognizing that their own knowledge and life experiences contribute to this logic. Parents wish to employ their youth in agricultural work at a young age and insist that doing farm work while young teaches youth how to be safe (Nilsson, 2016). Some parents argue that a minor injury mishap is beneficial to their youth because it allows them to learn independently (Nilsson, 2016). However, youth have limited life experiences, and it is more difficult for them to understand and analyze risks, in part because of their lower levels of cognitive ability.

Parents may begin assigning farm responsibilities while their child is only a few years old. According to Jean Piaget's Stage Theory of Cognitive Development, youth are in the Concrete Operational Stage during elementary and adolescence. In this stage, physical exposure accumulates, and the child can begin to create logical structures to explain their experiences (Huitt & Hummel, 2003). From adolescence into adulthood, the child reaches the Formal Operational Stage, which is the final stage of cognition. During this stage, individuals are finally capable of reasoning and their ability to think abstractly is at the level of an adult (Huitt & Hummel, 2003). However, Huitt & Hummel (2003) argue that many people do not think formally even as an adult. Until youth reach the Formal Operational Stage at 12 years and older, and arguably until they become an adult at 18 years, their decision-making abilities are not adequate in potentially hazardous situations, such as grain handling.

Parents may rely on age as an indicator to determine if their youth have the physical and cognitive skills to begin performing certain farm tasks (Jinnah & Stoneman, 2016). For example, when a child ages one year, they may be allowed to complete a task that they were not previously allowed to do. Frequently, a youth's gender also plays a role in determining their responsibility level on the farm (Summers et al., 2017). One study determined that fathers believed boys could safely operate machinery at a younger age than girls (Stoneman & Jinnah, 2016). This method is not rigid, however, as each set of parents likely has a unique system of delegating farm tasks to their children. Likely, the parents assign tasks according to their perception of their children's decision-making abilities.

According to Deutsch and Jones (2008), youth are socialized to understand that parents have authority over their children. Research by Landauer et al. (1970) found that a preexisting relationship between an adult and a child strongly predicts the level of child obedience. Based on

these findings, it is expected that youth who have a strong relationship with their parents would obey almost any orders. Still, there are two ways a child could respond to a parent-child disagreement (Phinney et al., 2005). According to Phinney at al. (2005) children will either focus on freedom from their parents' rules and follow their own inclinations, or they may comply with their parents' wishes in order to maintain a harmonious relationship. Research has yet to be conducted on the conditions under which youth would refuse to complete an unsafe farm order given by their parents. Although, it is expected that youth would refuse unsafe orders if they were aware of the hazards affecting the safe completion of the task. Youth decision-making was chosen as the method to study this phenomenon.

Factors Affecting Decision-Making Among Youth Workers in Agriculture

Published research has studied the decision-making processes of employees in occupational settings (Mosher et al., 2014; Mosher et al., 2013). Particularly, the pressures placed on the worker pertaining to personal safety, the need for productivity, their supervisor's authority or instructions, and influence by their coworkers or peers have been researched (Mosher et al., 2014; Kouabenan, 2009; Mullen, 2004). The same concepts could apply to youth workers making decisions on a family farm setting. While workers in the general industry typically have a manager providing work orders, youth in agricultural settings often have their parents serving in the supervisory role (Summers et al., 2017; Jinnah & Stoneman, 2016). Like any other worker, youth may have to make decisions that force them to choose between their personal safety, maintaining productivity, following their parent's orders, or a combination of the three.

The Theory of Cognitive Dissonance explains the relationship between two or more contradicting cognitions, which causes an uncomfortable state of mind (Festinger, 1957). A cognition is any piece of knowledge about an individual, their environment, or their world that

they believe to be right (Chadee, 2011). When a person encounters a case in which two or more cognitions oppose one another, they will attempt to quickly resolve this conflict to reduce the uncomfortable state of mind (Mosher et al., 2013). This theory can be applied to agricultural safety, in which a worker will use any prior knowledge, perhaps contradicting, to resolve a conflict. For example, a worker may have to decide between their company's policy and their supervisor's orders, which could be opposing actions. Both options are said to be right, but the worker must choose only one course of action to resolve their internal conflict. There are three ways which an employee could address a conflict: (1) ignore their own judgment and obey the leadership, (2) ignore the leadership and follow their own judgment, or (3) delay the decision until they are forced to act (Das et al., 2008). In any decision, the worker may have to choose between maintaining productivity at the workplace, following orders from their supervisor, or preserving their personal safety.

When comparing adult workers to adolescent workers, adolescents are more likely to conform to the authority's rules (Bronfenbrenner, 1970). Westaby and Lowe (2005) found that when the authority is stern about not taking risks while working, employees are more likely to reduce their risk-taking orientation. The same can be assumed about youth agricultural workers with a parent serving as their primary supervisor. If parents are clearly stern about not taking risks while completing farm work, it is expected that youth will be more mindful of their personal safety.

It was hypothesized that workers would rather complete a task quickly to make the leadership happy rather than take the extra time needed to complete a task safely (Mosher et al., 2014). This hypothesis assumes that workers would rather complete a task in favor of their supervisor's orders instead of taking the time to be safe. Completing a task quickly also allows

for a higher productivity level for the business. Maintaining a high level of productivity in agriculture is often vital during busy seasons, such as planting and harvest (Mosher et al., 2014). Work is often rushed to complete tasks quickly when there is favorable weather, which can lead to confusion about what is right: choosing safety, productivity, or a supervisor's authority. In the case of a youth working under their parents' direction on their family farm, the dilemma may be even more challenging to sort through.

A study by Mosher et al. (2014) sought to determine which factors played the most critical role in adult agricultural workers' decisions. The study presented grain elevator workers with a scenario and asked them to choose a course of action. The findings revealed that safety was the main factor in workers' decisions, whereas productivity, peer-pressure, and their supervisor's opinion were less critical to the decision-making process (Mosher et al., 2014). In comparison to youth in agriculture, it would be interesting to determine if the results concur with findings by Mosher et al. (2014). Research has yet to explore why youth make hazardous decisions regarding grain storage facilities and how parental supervision plays a role in youths' decisions. Additional research should analyze how the factors of personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure affect youths' decisions.

Summary

Agricultural confined spaces continue to cause a large number of injuries and fatalities each year (Cheng et al., 2019). In particular, grain bin entry poses specific threats of becoming entrapped or engulfed in grain. Sadly, one in five grain entrapment and engulfment cases involves a youth under 20 years old (Issa et al., 2016). As an exemption to the United States Department of Labor's Hazardous Occupations Orders for Agriculture, youth are permitted to work on their family farms at any age if their parent owns or operates the farm (2007). On the

family farm, the child's parent is likely to serve as the youth's direct supervisor while they complete agricultural work (Summers et al., 2017; Jinnah & Stoneman, 2016). Parents choose to involve their youth in farm work because they perceive the benefits outweighing the risks (Elliot et al., 2018). According to Summers et al. (2017), many parents use age and gender as indicators of their child's responsibility level on the farm. However, the cognition levels of farm youth may be too underdeveloped to assess risks or make sound decisions regarding hazardous activities (Huitt & Hummel, 2003). This fact is of concern due to the number of risky activities involved in completing agricultural tasks, especially regarding grain storage facilities. The youth then rely on their previous knowledge and experiences to make sound decisions.

The factors of safety, productivity, supervisor's authority, and peer pressure play a role in how workers make decisions (Mosher et al., 2014). Additionally, the hazard level of the task and the likelihood of engulfment likely affect youth decisions regarding entry into grain storage facilities. Because contradicting cognitions cause an uncomfortable state of mind (Festinger, 1957), research studying farm youth decision-making is needed to understand the factors contributing to youth grain entrapment and engulfment incidents.

Accordingly, the research questions for this study are as follows:

1. Why do youth choose to make hazardous decisions regarding grain storage facilities?
2. What role does parental supervision play in youth safety-related decisions on the family farm?
3. How do the factors of personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure affect youths' decisions?

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CHAPTER 3. METHODOLOGY

This research aimed to determine which factors played the most significant role in youth decisions to enter agricultural grain storage facilities. The factors to be considered were drawn from the literature on grain entrapments and engulfments, in addition to previous decision-making studies related to safety (Mosher et al., 2014; Kouabenan, 2009; Mullen, 2004). Factors included personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. This project utilized a multi-stage mixed-methods approach. Mixed-methods research collects and analyzes both quantitative and qualitative data to answer a research question (Creswell, 2012). Because the researcher collected quantitative data then qualitative data, the methodology followed an explanatory sequential process (Creswell, 2012).

The researcher designed a web-based survey via Qualtrics®[XM]. The survey instrument was pilot tested and validated by agricultural safety professionals and several members of student organizations at Iowa State University. The survey was then administered to Iowa State University students enrolled in selected academic departments. To be included in the study, participants self-reported having experience working inside grain bins while under 18 years old. Afterward, the researcher interviewed ten willing participants as a follow-up to the survey. Finally, both the quantitative and qualitative data were analyzed to determine the factors influencing youth entry into grain bins. In this chapter, the population, sampling frame, and research design are identified. Additionally, the development of the survey instrument and interview questions, data collection processes, and data storage are discussed. Finally, participant rights, response error, and research limitations are addressed.

Population, Sampling Frame, and Sample Design

The population in this study was students at Iowa State University who had experience working inside grain bins while under 18 years old. The sampling frame included students enrolled within the College of Agriculture and Life Sciences and whose academic majors were housed in the following departments: Agricultural and Biosystems Engineering, Agricultural Education and Studies, Agronomy, Animal Science, Horticulture, and Economics. This sampling frame created a large pool to sample from (N = 2,687 students). According to Creswell (2012), selecting as large of a sample as possible is vital in survey research so that it will be similar to the population. This large convenience sample was selected because the students were available to be studied, and those who participated were willing. Email was the primary mode of contact between the researcher and participants because it was the main form of university communication. The researcher obtained the email addresses of undergraduate and graduate students in the sampling frame through the University Registrar Office.

To be included in this study, participants self-identified as having prior experience working inside grain bins while under 18 years old. Therefore, the precise number of Iowa State University students within the aforementioned academic departments who met this criterion cannot be measured nor confirmed. All students enrolled in the selected academic departments were invited to participate in the study via email. Therefore, there is a possibility of coverage error, which occurs when every unit in a population does not have a known, nonzero chance of being included in the sample (Dillman et al., 2009). The survey instrument contained a screening question to ensure that participants met the criterion before they were permitted to continue their participation in the survey.

Coverage error was difficult to control due to the inclusion factors in the study. Since self-identification as having had experience inside grain bins while under 18 years is a subjective

criterion, the researcher chose to include students in the sampling frame who were enrolled in specific academic departments within the College of Agriculture and Life Sciences at Iowa State University. The researcher selected the six particular academic departments due to their hypothesized concentration of students with an agricultural background. Thus, it was expected that these departments had the highest number of students with grain bin experience as youth compared to other academic departments at the university.

Students who participated in the survey could mark their interest in completing a one-on-one follow-up interview with the researcher. Due to an unanticipated, overwhelming response of interested interviewees, the participants completed an additional screening survey. The researcher utilized the responses from the screening survey to select the ten interviewees who were most germane to the study's objectives. This additional survey created another convenience sample, as participants had previously indicated their willingness to participate. The researcher acknowledged that this small convenience sample might not represent the entire population. Rather than generalizing the interview results to the population, the researcher intended to better understand the ten participants within the interview sample. The screening survey allowed the researcher to select interviewees with abundant experience working inside grain bins and whose parents often served as their supervisor as they completed agricultural work. This confirming purposeful sampling strategy helped the researcher only interview the participants who were most relevant to the study (Creswell, 2012).

Survey Development

The survey was developed following the Tailored Design Method described by Dillman et al. (2009). The Tailored Design Method is a survey process that demonstrates to respondents a great benefit of participation, builds respondent trust, and has a goal to reduce error (Dillman et al., 2009). The survey design was cross-sectional, as it surveyed the attitudes, opinions, and

practices about a topic at one point in time (Creswell, 2012). According to Creswell (2012), survey researchers design worthy survey instruments by writing various question types, using good question composition, and performing a pilot test before administering the survey. All points were taken into consideration while developing the survey instrument.

The instrument also applied methods of social exchange to increase participant responsiveness and reduce errors. Social exchange calls for providing the respondents the benefits of participating in the survey, information about the study, and an ask for help (Dillman et al., 2009). The researcher treated participants with positive regard, appreciation, and support of group values (Dillman et al., 2009). Lastly, the researcher provided participants with a stimulating questionnaire, social validation, and limited opportunities to respond (Dillman et al., 2009). The researcher aimed to exhibit all social exchange methods to increase participant responses and lessen overall response error.

The respondents' benefit was internal and external – participants helped a master's student conduct their research, and they would receive monetary compensation if they were selected for a follow-up interview. The initial email's subject line shared a call for help: "Do you have grain bin experience? Share your insights!" The initial email and the survey introduction page provided participants with information about the study and how it could improve youth safety outcomes on family farms. To show positive regard, the researcher posted their contact information in various locations and actively sought out participant questions about the study. The researcher also sent several "Thank You" messages to respondents throughout the research process. The questionnaire itself was intriguing to respondents, especially if they had strong values in agriculture, youth safety, or grain storage and handling. The instrument was relatable to real-world experiences that respondents may have previously encountered on their farms. The

respondents felt social validation since only individuals with grain bin experience while under 18 years were able to participate. Finally, the limited opportunities to respond was exampled by only ten available interview slots following the survey.

According to Dillman et al. (2009), good quality survey questions are easy to understand. They also motivate the participant to answer accurately and encourage a response in the way that the survey creator intended (Dillman et al., 2009). The researcher constructed survey items that would motivate participants to respond. Creswell (2012) stated that good questions are straightforward and do not confuse participants. By using lay language relevant to agriculture at a reading level below the college-aged participants, the researcher intentionally crafted questions that participants would understand.

The survey utilized both close-ended and open-ended questions. Close-ended questions pertained to the collection of demographic information and the decision-making portion of the survey. In contrast, open-ended questions were strategically placed after yes-no questions to provide participants with an area to expand on their responses. According to Creswell (2012), open-ended questions are useful when the researcher is unaware of all the answer possibilities and would like to explore all the options. Open-ended questions offered space for respondents to elaborate on the item with no limiting factors (Dillman et al., 2009). On the other hand, because of the effort it takes to answer, open-ended questions are skipped more often than other question types, which may cause item non-response error (Dillman et al., 2009). The researcher acknowledged this limitation. To combat this issue, the researcher attempted to make open-ended questions as engaging as possible to entice participants to respond.

The survey instrument contained twenty questions. The first item asked if participants consented to participating in the study. The next question served as a screening question to

ensure that all participants had grain bin experience while under 18 years old. This question was a simple yes-no item. If participants answered “no,” they were thanked and eliminated from the study. If participants answered “yes,” they were asked to briefly describe why they were inside grain bins as a youth and what tasks they completed. This open-ended survey question provided examples in the prompt to trigger respondents’ memories. According to Dillman et al. (2009), questions about recent or remarkable events and behaviors are more straightforward for respondents to remember, increasing the accuracy of the response. Examples of reasons to enter a grain bin included in the prompt were: removing grain from the bin, playing in the grain, repairing machinery, and walking down grain.

Next, the survey presented participants with three realistic but hypothetical scenarios involving grain bins. Each scenario involved a conflict where the respondent would choose one of four actions as if they were faced with the dilemma in real life. The conflicts in the three scenarios consisted of (1) personal safety versus parental authority and pressure, (2) personal safety versus productivity, and (3) personal safety versus sibling and peer pressure. The answer choices were formed based on research by Das et al. (2008), who stated there are three ways an employee could address a conflict: (1) ignore their own judgment and obey the leadership, (2) ignore the leadership and follow their own judgment, or (3) delay the decision until they are forced to act. At least one answer choice per scenario question corresponded with each of the actions described by Das et al. (2008).

Following the three decision-making scenarios, respondents were then asked to rank various factors according to how they affected their decisions. Participants ranked the factors in order from the highest priority, or most important to the decision-making process, to the lowest priority, or least important. The factors to be ranked depended on which scenario they were most

relevant, and included personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure.

The survey also collected demographic information from respondents. Background or demographic questions are employed to evaluate the individuals' personal characteristics in the sample (Creswell, 2012). Gender, age, and state were close-ended, drop-down or radio-button questions. County in the state of residence, as well as academic major, were asked in open-ended formats. This question structure allowed participants to type in their county and academic major instead of searching through a long list of possibilities. The open-ended format was utilized with the intent to increase the item response to these questions.

Subsequently, participants were asked a potentially sensitive question – had they ever been entrapped or engulfed in grain while under 18 years old. If the answer was "no," the participants were directed to the final survey question. If the answer was "yes," three additional questions appeared. Two close-ended questions asked about the year of the entrapment or engulfment and the participant's age when the incident occurred. These questions appeared in radio-button formats. One open-ended question asked participants to briefly describe how they became entrapped or engulfed in grain. Participants were reminded that they only had to answer this question "if they wished." The sensitive question appeared late in the survey after the participant had already built a rapport with the researcher by previously answering neutral questions (Creswell, 2012).

Finally, participants indicated their interest in participating in a follow-up interview. Participants clicked on a website link that was included in the final question prompt. This link directed them to an additional Qualtrics®[XM] survey. The additional survey contained a text box for participants to input their email address. This method of collecting contact information

prevented the researcher from connecting personal identifying information, such as email addresses, with participants' survey answers.

Participant Rights

Before any data collection began, the researcher obtained permission from the Iowa State University Institutional Review Board (IRB). The IRB served as a witness to the project's welfare, rights, and privacy of the study's human subjects. The project was declared exempt on February 24, 2020 (IRB ID 20-044). The Category 2 exemption affirmed that the research only included regular, non-sensitive survey and interview procedures that would not place the participants in any harm. The exemption also declared that the survey was anonymous, and the interview audio-recordings were confidential and private.

This research was automatically issued a Certificate of Confidentiality from the National Institute for Occupational Safety and Health per NIH policy NOT-OD-17-109. The certificate served as additional protection for student participants. The Certificate of Confidentiality stated that the researcher could not share identifying information about participants to anyone not affiliated with the research, even under a court subpoena.

Participation in both the survey and the interview was voluntary, and participants could stop their involvement at any time with no punishment. They could also decline to answer any particular item on the survey or interview for any reason. Neither the survey nor the interview asked participants questions that were considered high-risk. The survey asked questions about farm practices that are common and legal. One item on the survey asked if the participant had ever been entrapped or engulfed in grain. If yes, the participant was asked if they wished to explain the situation that led to the incident. This item could have stirred up negative emotions. Thus, the question prompt provided participants the option to not answer this item if they felt uncomfortable. The additional survey used to screen interview participants asked more specific

information on the participants' experiences working inside and around grain bins while under parental supervision or alongside siblings or peers. The screening survey did not include high-risk questions. Finally, the interview asked participants about the survey instrument that they had responded to several weeks prior. It also asked about the interviewee's personal experiences inside grain bins and working with their parents and siblings. Similar to the surveys, none of the interview questions were considered high-risk.

Survey Validity and Reliability

According to Litwin (1995), validity is evidence that the survey instrument measured what it intended to measure. Content validity is the suitability of content matter within a survey and is validated by persons who have some relevance to the subject (Litwin, 1995). The researcher obtained content validity by leaning on various agricultural safety and health professionals' expertise, many of whom have industry experience specific to grain handling and storage. Six professionals had land-grant university affiliations in the area of agricultural safety and health, and three professionals worked in industry settings, such as cooperatives, in the safety area. The director of an agricultural safety and health organization was the last professional. The survey instrument was distributed to the professionals for their review. Comments for change included survey flow, adding clarity to the wording of questions and answers, and the potential of leading participants to specific responses.

The researcher also conducted a pilot test of the survey instrument before administering it to the sample. A pilot test is when the researcher employs an instrument to a small group within the sample and changes it based on individuals' feedback (Creswell, 2012). The researcher contacted several student organizations within the Iowa State University College of Agriculture and Life Sciences (CALS) to pilot test the survey. The targeted student organizations were the American Society for Agricultural and Biological Engineers, Agricultural Systems Technology

Club, CALS Student Council, and Block and Bridle. These student organizations were selected due to the anticipated number of student members who had grain bin experience while under 18 years old. Therefore, many student members would qualify to participate in the study. The researcher sent one email to each club president, whose contact information was obtained from the Iowa State University student organization website. The survey was disseminated throughout the student organizations, and students could provide individual feedback to the researcher via email. Comments from the pilot test students included clarity in question wording and instructions on how to answer some questions.

A reliable survey instrument produces consistent scores (Creswell, 2012). Reliability is met when a specific instrument is repeatedly administered to the same participant and the same results are produced each time (Oluwatayo, 2012). An instrument's scores are determined reliable if a particular individual's scores are internally consistent across the entire survey (Creswell, 2012). For example, if a student participant in the survey chose a risk-averse option while answering the first scenario, they are expected to choose risk-averse options throughout all three scenarios. It is also expected that they hold their personal safety in high regard while ranking the factors that affected their decisions. On the contrary, participants who select high-risk choices are expected to do so consistently throughout the survey instrument and place little value in maintaining their personal safety.

Data Collection – Survey Administration

The initial contact was sent at 10:00 AM Central Time on Monday, March 2, 2020. An email inviting students to participate, with the subject line stating: "Do you have grain bin experience? Share your insights!" was sent to 2,687 Iowa State University students enrolled in the six selected academic departments. The email contained the survey link that students could click on to participate. One week and one day later, at 10:00 AM Central Time on Tuesday,

March 10, 2020, a reminder email was sent through Qualtrics®XM to all students who had not yet responded to the survey.

There were 229 recorded responses for the initial survey (11.73% response rate). Although the response rate was low, the sampling frame was much larger than the anticipated number of participants who met the criterion of having grain bin experience while under 18 years old. Therefore, there is no way to definitively measure the number of students that were eligible to participate. Of the 229 recorded responses, 206 participants met the criterion of having grain bin experience while under 18 years old (7.66% usable response rate), and 169 respondents completely finished the survey (6.28% finished response rate).

Participants indicated their willingness to complete a brief follow-up interview on the last question of the survey. If interested, participants would click on a link presented in the final survey question prompt, which transferred them to a different Qualtrics®XM survey. In this second survey, participants input their contact information. This method eliminated the connection between individual participants' responses and their contact information, maintaining the anonymity of participant responses.

The participants who claimed their interest in a follow-up interview were sent a third, shorter survey. This additional survey helped the researcher select interviewees who were most germane to the study. The contact was made via email to interested students (N = 53) on Monday, March 23, 2020 at 12:30 PM. Most participants responded to the third survey (n = 40), and there was a 75.47% response rate. Seven questions comprised the third survey. The survey asked participants to describe the farm operation they worked on as a youth and rank their level of involvement with the farm operation. It also asked participants to estimate the number of

times they have been inside grain bins, rank how often their parents served as their supervisor during farm work, and rank how often they worked around grain bins with siblings or peers.

Data Collection – Follow-Up Interviews

The researcher used the data from the third survey to select participants for follow-up interviews. The researcher's first preference was participants who identified having personal experience inside grain bins over twenty times. Selected interviewees were also highly involved in their farming operations as youth and were frequently supervised by their parents as they worked inside or around grain bins. The researcher was aware of response bias in the interviews due to the hand-selection from the convenience sample. The researcher acknowledged that the ten selected interviewees might not be representative of the entire study population (Creswell, 2012).

The interview followed Merriam's basic qualitative research design (2016). Because qualitative research is based on the underlying theory of social constructivism, this portion of the study sought to, "Understand how people make sense of their lives and their experiences" (Creswell, 2009, p. 24). Creswell (2012) stated that social constructivism is a suitable theoretical framework when the analysis reveals how individuals interact with their world. This research sought to explore youths' social constructivism to make sense of their experiences completing a hazardous farm task while under their parents' supervision. This approach was deemed appropriate due to the anticipated differences in participants' interactions with grain bins and working under parental supervision.

WebEx™, the online communication software affiliated with Iowa State University, was used to interview participants. The software allowed for a virtual "face-to-face" interview experience. Interviews were conducted between March 2020 and May 2020 at a convenient time for both the researcher and interviewee. Each meeting lasted between 21 and 36 minutes. The

interview conversations followed a qualitative format, where the researcher asked participants open-ended questions and allowed the interviewees to respond without response options (Creswell, 2012). The interviews were semi-structured (Merriam, 2016). The researcher asked the interviewees questions as they arose in conversation, but also ensured that all prepared study questions were asked by the end of the interview.

Before conducting the interview, the researcher obtained written consent from the interviewees to audio-record the conversations. This process was conducted through email. In addition, before beginning the interview, the researcher verbally asked the participant to respond with a "yes" or "no" as consent to audio-record the conversation. In all ten interviews, the interviewee consented. Before starting the interview, the researcher read the interviewee a short statement thanking them for their availability and willingness to participate in the study. The statement also encouraged participants to tell short personal stories throughout the interview, but to please refrain from sharing identifying information about themselves or other characters in the stories. Finally, the statement ensured the participants' confidentiality. It reminded participants that their names would not be shared in any final reports, and instead, to grant anonymity, they would be referred to as "Interview Participant X."

Seventeen interview questions asked about two general topics: the survey that participants answered several weeks prior and participants' personal experiences working around grain bins with their parents and siblings. The first half of the interview presented participants with the decision-making scenario questions from the survey. The researcher revealed the most popular answer choices for each scenario question and asked about the interviewees' reactions upon hearing the results. The researcher also revealed the least popular choices. While the interviewee was not necessarily encouraged to share their personal answers to the scenarios, the

researcher recorded any thoughts the interviewee had to the results. Furthermore, the researcher shared the most common ordering of the factors that were ranked from the highest importance to the lowest in terms of how they affected participants' decision-making process. Again, the researcher was not interested in the participants' personal ranking of the factors, but rather their reaction to the most frequent ordering.

Following the interview questions about the survey, the researcher then asked the interviewees about their specific experiences working inside and around grain bins. Interviewees recalled the most recent situation when they entered a grain bin and listed the safety precautions they took, if any, before entry. The researcher asked where the interviewee had learned most of their agricultural safety knowledge and asked participants to describe the situations when their parents served as their supervisor while completing farm work. Interviewees explained under what conditions they would follow their parents' or siblings' directions to complete a farm task, even if they knew the situation was unsafe. On the other hand, interviewees also revealed situations when they would refuse to follow their parents' or siblings' directions until they could safely complete the task. Finally, interviewees stated their opinions on the most substantial obstacles to complete farm tasks safely.

Triangulation methods were utilized throughout the interview by comparing participants' interview responses to their selection criteria survey responses (Denzin, 1978). By utilizing triangulation, the internal validity of the interview process was increased (Denzin, 1978). Additionally, member checks were conducted for validation purposes. By asking for interviewee feedback, the interpretation of preliminary findings was more accurate and credible (Merriam, 2016).

Upon completion of the follow-up interview, participants were awarded a $20 gift card incentive as compensation for their time. Because all interviews took place virtually using WebEx™, an alternative method for transporting the gift card from the researcher to the interviewee was required. In all ten instances, the interviewee felt comfortable enough to provide the researcher with their home address. The researcher packaged the gift card in an envelope and mailed it to the interviewee's residence. Once the interviewee received the gift card, they filled and signed a Property Receipt Form stating that they had received the gift card. Participants then returned the form to the researcher via email. Upon obtaining the signed compensation agreement form, the researcher deleted records of the interviewees' addresses, so they remained confidential.

Data Storage and Processing

The researcher administered the surveys through Qualtrics®XM survey software. Completed survey data was stored in the online Qualtrics®XM platform for analysis at a later time. The Qualtrics®XM account used to create and administer the survey was password-protected, so there were no threats about a lack of confidentiality or security in the storage of survey data. Only the researcher had access to the files through their personal, university-affiliated credentials.

The researcher ran basic reports of the quantitative survey data using Qualtrics®XM. The data was exported to Microsoft® Excel sheets and stored in CyBox, the online data storage software affiliated with Iowa State University. The documents were stored for later analysis. Only the research team had access to the confidential documents. Because no personal identifying information could be derived from the original survey data, individual participants' results remained anonymous.

The researcher utilized IBM SPSS® (version 27) software for quantitative data analysis. Descriptive statistics were used to describe the frequency, general tendency, and variation of the survey's quantitative data. The researcher also utilized inferential statistics, such as Pearson's chi-square test, to determine if there were relationships between the variables. To explore the strength of the dependent relationships, the researcher analyzed the standardized adjusted residuals described by Agresti & Finlay (1999, p. 261-262). A statistical analysis developed by Keren et al. (2006) was utilized to examine the significance of individual decision-making factors versus all other factors. Lastly, a t-test analysis was used to complement the decision-making factor results. The t-tests determined the significance of each factor's mean value with the hypothesized mean value.

Interview data were also stored in the online, password-protected platform, CyBox. Only the researcher had access to these confidential files. Because the interviews took place using WebEx™ video conferencing software, the interviews were audio-recorded. The audio-recorded video files were stored so the researcher could extrapolate data at a later time. Following each interview, the researcher transcribed the recording using Microsoft® Word and stored the transcription files in CyBox.

The researcher used Glaser and Strauss's approach to simultaneously collect and analyze the qualitative data (1967). Using the constant comparison method (Glaser & Strauss, 1967), interviews proceeded until saturation was reached for the main themes. Themes were coded using Microsoft® Word. The researcher developed a color-coding process to differentiate between themes, which were created based on the study's three research questions. Following a complete data analysis of the ten interviews, the researcher deleted the audio-recorded video files for all interviews.

Response Error

Survey researchers seek a high survey response rate for the purpose of confidently generalizing the results to the population (Creswell, 2012). There are three nonresponse behaviors in web surveys: unit nonresponse, breakoff, and item nonresponse (Bosnjack & Tuten, 2001). Unit nonresponse is when respondents choose not to answer the survey at all, potentially due to a lack of motivation to begin their participation (Bosnjack & Tuten, 2001). The researcher has no way to test for unit nonresponse in this survey, as the criterion for inclusion in this study was subjective.

Survey breakoff occurs when a respondent begins a survey but does not fully complete it (Peytchev, 2009). In this study, survey breakoff was indicated by the 206 participants who started the survey and were qualified to participate, but only 169 participants finished the survey. According to Peytchev (2009) breakoff is common in web-based surveys and poses a threat to survey inference. Survey breakoff is likely affected by the opportunity to continue the survey due to time restraints or a lack of technology (Bosnjack & Tuten, 2001). This study's survey settings required participants to finish responding to the survey in one sitting. The researcher expected some level of survey breakoff to occur, although the estimated time for completion was approximately ten minutes.

Finally, item nonresponse is the willingness of participants to respond to all types of questions (Bosnjack & Tuten, 2001). Item nonresponse is likely affected by a respondent's aptitude to want to provide certain information (Bosnjack & Tuten, 2001). According to Weisberg (2005), survey nonresponse is an issue when there is a difference between respondent and nonrespondent characteristics, values, behaviors, and attitudes. This study did not see significant item nonresponse error. If participants did not answer specific questions, it was typically from a breakoff standpoint instead of nonresponse to particular survey items.

The researcher aimed to create and distribute an appealing survey to maintain respondents' motivation to complete the entire instrument. Creswell (2012) stated that individuals are more willing to complete a survey if they are interested in the issue. According to Dillman et al. (2009), without motivation to answer the survey correctly, participants may misread questions, provide incomplete answers, ignore the survey instructions, or fail to complete the survey altogether. To combat this issue, the researcher chose to implement engaging inquiries in the survey to prevent unmotivated participants from becoming uninterested.

Limitations

A potential issue within a research study is a limitation (Creswell, 2012), and recognizing limitations in any research study is essential (Connelly, 2013). This study included several limiting factors. The limitations included participant social desirability bias, relying on respondents' memory recall, the hypothetical nature of the scenario questions, the location, scope, and scale of the study, the one mode of communication, the timeline of the study, and the need to transition from in-person means to online means during the worldwide COVID-19 pandemic.

In survey research, response bias is when the responses provided do not accurately represent the actual views of the sample or the population (Creswell, 2012). Based on the findings, participants may have held safety in higher regard than if presented with the scenario in a real-life situation. Social desirability bias occurs when research participants answer questions in socially desirable ways instead of responding in ways that reveal their true feelings or stance (Grimm, 2010). The researcher hypothesized that because participants knew this project was about farm safety, they responded to questions in a more risk-averse manner. Despite responding in a more risk-averse way in the study, students might choose a different course of action if

presented with the grain handling scenario in real life. To help combat social desirability bias, a page appeared before the decision-making scenario questions on the survey. The page reminded participants that, “There are no right or wrong answers” and that the researcher was interested in, “How you would first react if you were in each situation.” Despite the reminder, it is possible that some participants still answered on behalf of social desirability bias.

Questions about recent or remarkable events are easier for respondents to remember, which may increase the accuracy of participants’ responses (Dillman et al., 2009). However, questions asked during the interview process in this study had participants recalling information from when they were under 18 years old. Some participants were old enough to be recalling experiences from over eight years ago, while others may have been remembering times from one year ago or less. It is possible that participants could have inaccurately recalled information about their grain bin experiences from when they were youth, which may have slightly skewed the qualitative data gathered.

The scenarios were intended to be as realistic as possible. Nevertheless, the scenarios remain hypothetical. How respondents would answer in theory versus in actuality should be considered. What a participant says they “might” do in a situation may differ from what they would “actually” do. Therefore, it is acknowledged that a participant could have answered the scenario one way on the electronic survey but may have responded differently if presented with the scenario in a real-life situation.

This study surveyed and interviewed students from one land-grant institution in the Midwestern United States: Iowa State University. Because this study only reached across one college at one university, the results cannot be generalized to other universities in the Midwest or other areas of the United States. The researcher acknowledged this limitation at the beginning of

the study. It was determined that the inclusion of other universities was not in the scope of this project.

Due to the nature of today's university system, the researcher expected that students regularly used their university email addresses as the primary form of academic communication. Therefore, the researcher utilized a web-based survey to reach the broadest range of students. The researcher also hoped to take advantage of using email, which was thought to be the most accessible and widely-utilized student communication channel. Undoubtedly, some students, despite email being the central university communication method, do not regularly check their email inbox. Therefore, some students who were qualified to participate in the study may have missed the call for survey participation and were therefore excluded.

Less than two weeks after the initial survey was administered, the world entered a global pandemic state due to COVID-19. Iowa State University administration decided to eliminate in-person classes, and therefore the remainder of the Spring 2020 semester was conducted in a virtual format. The virtual arrangement of academics and research led to complications with the initial plan for the interviews. Interviews were supposed to be conducted in-person, using an audio-recording device to capture the researcher-participant dialogue. However, because of the university's new protocols, all research was to be conducted virtually. Therefore, interviews had to be performed using WebEx™ conferencing software. The conversations were still able to be audio-recorded. Though, due to the nature of an online interview versus an in-person interview, participants' answers may have slightly changed due to the personal disconnect between the researcher and the interviewee.

Another difficulty surrounding the virtual nature of the interviews was compensation. Because the researcher and the interviewee were not in the same room during the interviews, the

researcher could not physically hand the interviewee their compensation gift card immediately upon finishing the interview. The researcher was required to obtain addresses for each interviewee and mail the gift card to their residence. While the researcher was able to maintain confidentiality with the interviewees' addresses, this process of compensation delivery was unexpected.

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Appendix. Institutional Review Board Declaration

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 02/25/2020

To: Gretchen Mosher

From: Office for Responsible Research

Title: **Understanding Parent Influences on Youth Decisions to Enter Agricultural Grain Storage Facilities**

IRB ID: **20-044**

Submission Type: Initial Submission **Exemption Date:** 02/24/2020

The project referenced above has been declared exempt from most requirements of the human subject protections regulations as described in 45 CFR 46.104 or 21 CFR 56.104 because it meets the following federal requirements for exemption:

2018 - 2 (ii): Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) when any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for continuing review. Instead, you will receive a request for a brief status update every three years. The status update is intended to verify that the study is still ongoing.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any *modifications to the research procedures* (e.g., method of data collection, nature or scope of information to be collected, nature or duration of behavioral interventions, use of deception, etc.), any change in *privacy or confidentiality protections*, modifications that result in the *inclusion of participants from vulnerable populations*, removing plans for informing participants about the study, any *change that may increase the risk or discomfort to participants, and/or* any change such that the revised procedures do not fall into one or more of the regulatory exemption categories. The purpose of review is to determine if the project still meets the federal criteria for exemption.

- All ***changes to key personnel*** must receive prior approval.

- **Promptly inform the IRB of any addition of or change in federal funding for this study.** Approval of the protocol referenced above applies only to funding sources that are specifically identified in the corresponding IRB application.

  Detailed information about requirements for submitting modifications for exempt research can be found on our website. For modifications that require prior approval, an amendment to the most recent IRB application must be submitted in IRBManager. A determination of exemption or approval from the IRB must be granted before implementing the proposed changes.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Additionally:

- All research involving human participants must be submitted for IRB review. **Only the IRB or its designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

- **Please inform the IRB if the Principal Investigator and/or Supervising Investigator end their role or involvement with the project** with sufficient time to allow an alternate PI/Supervising Investigator to assume oversight responsibility. Projects must have an eligible PI to remain open.

- **Immediately inform the IRB of** (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.

- **Approval from other entities may also be needed**. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted**.

- Your research study may be subject to **post-approval monitoring by Iowa State University's Office for Responsible Research**. In some cases, it may also be subject to formal audit or inspection by federal agencies and study sponsors.

- Upon completion of the project, transfer of IRB oversight to another IRB, or departure of the PI and/or Supervising Investigator, please initiate a Project Closure in IRBManager to officially close the project. For information on instances when a study may be closed, please refer to the IRB Study Closure Policy.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

CHAPTER 4. PARENTAL INFLUENCE ON YOUTH DECISIONS TO ENTER AGRICULTURAL GRAIN BINS

Modified from a manuscript under review in *Journal of Agromedicine*

Kayla N. Walls & Gretchen A. Mosher
Department of Agricultural and Biosystems Engineering, Iowa State University

Abstract

The approach parents take in the supervision of hazardous tasks can affect youth safety outcomes on family farms. This research examines the most significant factors affecting youths' decisions to enter agricultural grain storage facilities. Over 200 students attending a Midwestern land-grant university who had grain bin experience as youth completed a decision-making survey. Students chose from a list of actions in three realistic but hypothetical scenarios involving grain bin entry, and ranked factors justifying their decision choice, according to the level of importance in their decision. Although most participants chose options that emphasized safety when answering the scenario questions and held the "personal safety" factor in highest regard, some chose higher risk options and valued "productivity." The findings revealed that parental authority and pressure has little influence on youth decisions to enter grain bins. The study's limitations are addressed, as are the implications of these findings on youth safety outcomes on family farms.

Introduction

In 2012, there were approximately 14,000 documented injuries of youth living on, working on, or visiting United States farms (Hendricks et al., 2018). Youth in agriculture are at a unique risk for injuries for several reasons. The lack of separation between their home and work is a primary reason (Rivara, 1997), but there are other risk factors. Youth are more susceptible to injury because they are smaller, weaker, and lack maturity and experience (Arcury et al., 2015).

The frequency of injuries and fatalities of agricultural youth has declined in recent years; however, this is not the case when analyzing incidents involving grain storage facilities, or grain bins (Issa et al., 2016).

A grain bin is a type of confined space that poses both entrapment and engulfment hazards. Grain entrapment is a partial submersion where the victim's head remains visible above the line of grain, whereas grain engulfment is where the victim is fully submerged, and their head is not visible above the line of grain (Issa et al., 2017). Historically, one in five recorded grain entrapment and engulfment cases has involved a youth under 20 years old (Issa et al., 2016). In 2018, one in three cases involved a youth under 21 (Cheng et al., 2019).

In an industry with the second-highest fatality rate among youth workers, there are regulations dedicated to protecting young employees' health and welfare (Miller, 2012). The Hazardous Occupations Orders for Agriculture labeled eleven tasks as too dangerous for youth under 16 to complete. One task is, "Working inside a fruit, forage, or grain storage designed to retain an oxygen-deficient or toxic atmosphere" (U.S. Department of Labor, 2007, p. 5). However, there are exemptions to this regulation, including, "Youths employed on farms owned or operated by their parents" (U.S. Department of Labor, 2007, p. 5). Thus, exempt from the federal rule, youth partake in grain storage-related tasks on their family farms – often while their parent is supervising their work.

Parent and Youth Interface in Agriculture

Parents involve their children in farm work in part because they perceive the benefits outweighing the risks (Elliot et al., 2018). Parents recognize their responsibility in making the farm environment as safe as possible for their youth yet feel unable to protect them in every way (Nilsson, 2016). Parents modeling safe farm behaviors could mitigate their youth's risk-taking

tendencies (Jinnah & Stoneman, 2016). Still, unsafe behaviors occur. A positive correlation between fathers' unsafe farm behaviors and their children's behavior has been documented, as youth often mimic their elders (Jinnah & Stoneman, 2016).

Nearly half of all youth injured on the farm are under the supervision of an adult who is actively completing farm work (Wright et al., 2013). This fact debunks the myth that keeping youth in close proximity to the parent will keep them safe (Summers et al., 2017). Parents often assume that farm safety is "common sense" (Summers et al., 2017) and that safety conversations can be disregarded because their youth know the hazards. Some parents insist that doing farm work while young teaches youth how to be safe and argue that a minor injury is beneficial because it allows youth to learn safety on their own (Nilsson, 2016). However, because youth have limited life experience, they require explicit safety training and the assignment of age-appropriate tasks.

Youth Development and Risk-Taking

Sometimes, parents rely on a child's age to determine when youth can complete specific farm tasks (Jinnah & Stoneman, 2016). Per Piaget's Stage Theory of Cognitive Development, individuals are inadequate at reasoning and abstract thinking until they reach the Formal Operational Stage at 12 years old (Huitt & Hummel, 2003). Farm tasks that require complex thinking and reasoning may be inappropriate for youth to complete.

Gender is often another determinant of youth responsibility level on the farm (Summers et al., 2017). Stoneman and Jinnah (2016) determined that fathers believed boys could safely operate machinery at a younger age than girls. This belief was true even though the number of youth farm injuries increases with age, and boys are twice as likely to be injured than girls

(Rivara, 1997). Gender also plays a role in risk-taking propensity, as boys are twice as likely to partake in risky activities than girls (Lasenby-Lessard et al., 2013).

Youth who have increased experience with an activity may show heightened risk-taking, and the experience may not necessarily translate into lower levels of injuries (Lasenby-Lessard et al., 2013). Instead, more experience may lead to more injuries because children may take added risks with familiar activities. According to Lasenby-Lessard et al. (2013), children will take added risks when they assess an activity as having low danger and low vulnerability for injury. Thus, continuous exposure to grain storage facilities likely leads to lower risk-assessment levels due to youths' increased experience. Because of their added experience with specific activities, youth decision-making could be skewed.

Decision-Making

The Theory of Cognitive Dissonance explains the relationship between contradicting cognitions, which causes an uncomfortable state of mind (Festinger, 1957). An individual will typically attempt to quickly resolve contradicting cognitions to reduce the mind's discomfort (Mosher et al., 2013). There are three ways an employee could address conflict: (1) ignore their judgment and obey the leadership, (2) ignore the leadership and follow their judgment, or (3) delay the decision until forced to act (Das et al., 2008). The same can be concluded about a youth working on their family farm with their parent serving as their direct supervisor.

Various factors play a role in decision-making. A study by Mosher et al. (2014) presented adult workers with a grain bin entry scenario and asked them to choose an action. The study found that safety was the main factor in worker decisions, whereas productivity, peer-pressure, and supervisor opinion were less critical to the decision-making process (Mosher et al., 2014).

Previous research acknowledges that youth work on their family farms under parental supervision (Summers et al., 2017; Jinnah & Stoneman, 2016; Stoneman & Jinnah, 2016). Any worker must make decisions based on their safety knowledge and external pressures (Mosher et al., 2014). This study seeks to determine if youth decision-making patterns concur with adult workers regarding grain bin entry, as documented by Mosher et al. (2014). Data were collected in response to two research questions:

1. What role does parental supervision play in youth safety-related decisions on the family farm?
2. How do the factors of personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure affect youths' decisions?

Methods

The study population included students enrolled in the following departments at a Midwestern land-grant institution: Agricultural and Biosystems Engineering, Agricultural Education and Studies, Agronomy, Animal Sciences, Horticulture, and Economics (N = 2,687 students). The sampling frame included students who self-identified as having experience inside grain bins while under 18 years old. The precise number of students within the targeted departments who met this criterion cannot be measured or confirmed. Therefore, coverage error is possible, and the findings cannot be adequately generalized to the targeted population (Dillman et al., 2009).

Survey

The Qualtrics®^{XM} platform was used for survey development and administration. The Dillman et al. Tailored Design Method (2009) helped frame the survey development process.

Participant consent was obtained, followed by a screening question to ensure all participants had been in a grain bin while under 18. Included participants were asked to describe why they were in grain bins as a youth and what tasks they completed.

Next, the survey presented three scenarios involving grain bins. Students chose an action that best reflected how they would react if they were presented with that scenario on their family farms. The scenarios read:

Scenario #1

> *You are working with your parent to unload a grain bin on your family farm when you notice the auger is moving less corn than before. Your parent suggests there may be a blockage of bad grain and asks you to drop into the top of the bin to physically break up the obstruction while the auger continues running. Your parent agrees to supervise the auger.*
>
> *What is your next step?*
>
> *A. Enter the grain bin the remove the blockage*
> *B. Use a pole to break up the blockage from outside the bin*
> *C. Wait five minutes to see if the blockage breaks down itself*
> *D. Tell your parent it is dangerous to enter the bin*

Scenario #2

> *Your neighbor agreed to help you unload corn from your bin when she gets home from work at 4:00 PM. The local elevator closes at 5:00 PM, and you need to take in your final load of the season to complete your contract. You figure you can at least start without your neighbor's help, and as the clock is ticking, you think about entering the bin to walk down the corn for quicker loading.*
>
> *What is your next step?*
>
> *A. Call your neighbor to see how much longer they will be*
> *B. Wait ten minutes and then check the progress of the unloading*
> *C. Enter the bin to walk down the corn, potentially speeding up the unload*
> *D. Patiently wait for the grain to unload*

Scenario #3

> *You have a sibling of the same gender and similar age. You are both working to unload a grain bin when you learn there is moldy corn caked on the side of the bin from top to bottom. Your sibling offers to enter the bin to break up the moldy corn they can reach with a shovel. Your sibling suggests you turn off the auger and help him/her break up the blockage.*
>
> *What is your next step?*
>
> *A. Beat on the outside of the bin to break up the blockage*
> *B. Communicate the possibility of avalanched grain to your sibling*
> *C. Enter the bin to remove the blockage with your sibling*
> *D. Wait a few minutes to see if the blockage breaks down itself*

Respondents then ranked the importance of factors that affected their decision-making in the scenarios. The factors were chosen based on their significant association with safety decision choices in previous research (Mosher et al., 2014; Kouabenan, 2009; Mullen, 2004). The factors included personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure.

The instrument also collected demographic data such as age, gender, home state, and academic major. Lastly, the survey asked if the participant had been entrapped or engulfed in grain while under 18 years. If so, the participant was asked the year of the incident, how old they were when the incident occurred, and, if they wished, to briefly describe the situation.

Results were calculated using IBM SPSS® (ver. 27). Statistical analyses were performed to determine relationships between variables, the strength of the relationships, and the importance of certain decision-making factors.

Results

Participant demographics are located in Table 4.1. Of the 229 recorded responses, 206 participants had grain bin experience while under 18 and were therefore included in the study.

Participants who met this criterion were involved with the following grain bin experiences: cleaning or removing grain from the bin (*n* = 172, 92.9%), repairs and maintenance (*n* = 67, 36.2%), playing inside the bin (*n* = 33, 17.8%), checking the grain level, condition, or moisture content (*n* = 25, 13.5%), or leveling grain (*n* = 20, 10.8%).

One student disclosed that they had been entrapped in grain as a youth. The incident occurred in 2006 when the individual was 11 years old. According to the participant, they were, "Cleaning a bin and following [the] sweep and was wrapped in [the] auger." The participant stated that the local fire department came to the farm to rescue them, and they were later flown to the area hospital for treatment.

Table 4.1. Characteristics of Student Sample

Gender[1]	Frequency	Percentage
Male	113	66.9%
Female	56	33.1%
Age[2]		
18-21	132	78.1%
22-33	37	21.9%
State[3]		
Iowa	133	79.2%
Non-Iowa	35	20.8%
Academic Major[4]		
Ag. & Bio. Engineering	28	16.7%
Agricultural Business	39	23.2%
Agricultural Studies	34	20.2%
Agronomy	39	23.2%
Animal Science	28	16.7%

Note: [1]*N* = 169, [2]*N* = 169, [3]*N* = 168, [4]*N* = 168

Scenarios

Chi-square tests of independence were performed to determine the relationship between the way participants answered each scenario and the factors of gender, age, state, and academic major. The level of significance (α) was .05. Two of the variable pairs were significant: the relationship between gender and Scenario #2, X^2, (3, N = 169) = 12.41, p = .006, and the relationship between gender and Scenario #3, X^2, (3, N = 169) = 8.56, p = .035. Table 4.2 shows the associations between the demographic variables for each scenario.

Table 4.2. Chi Square Values and Significance Levels of Variable Pairs Per Scenario

Variables		Chi-Square Value	Degrees of Freedom	Significance Level
Scenario #1:	Gender	7.13	3	0.067
Safety vs. Parental Authority	Age	0.41	3	0.938
	State	3.68	3	0.298
	Major	10.31	12	0.589
Scenario #2:	Gender	12.41	3	0.006*
Safety vs. Productivity	Age	1.85	3	0.602
	State	3.86	3	0.276
	Major	9.58	12	0.651
Scenario #3:	Gender	8.56	3	0.035*
Safety vs. Sibling/Peer Pressure	Age	1.85	3	0.603
	State	1.23	3	0.745
	Major	16.37	12	0.174

Note: * significant at α = 0.05

The standardized adjusted residuals were analyzed to determine the strength of the dependent relationships (Agresti & Finlay, 1999, p. 261-262). The positive or negative sign of the residuals depend on the difference between the observed frequency of a variable versus its expected frequency. When the observed frequency is higher than the expected frequency, a positive residual is detected. Conversely, when the observed frequency is less than the expected frequency, a negative residual is found (Agresti & Finlay, 1999, p. 261-262). An adjusted residual value greater than 2 suggests a dependent relationship between a pair of variables. However, substantial evidence for a dependent relationship between two variables is demonstrated when an adjusted residual value is greater than 3 (Agresti & Finlay, 1999, p. 261-262). The adjusted residual analyses are outlined in Tables 4.3, 4.4, and 4.5.

Based on the standardized adjusted residual analysis, there is a strong association between males and entry into grain bins in all three scenarios. Conversely, females are more likely to communicate with their parents or siblings or patiently wait for the task at hand. The younger population, 18 to 21-year-olds, are more likely to choose options that are productive but do not require them to enter the bin. This population had strong associations with using a pole to break up the blockage, beating on the outside of the bin, communicating, or waiting. There is some evidence of the older population, 22 to 33-year-olds, communicating with others as well. Iowa-residents had strong associations with using a pole to break up the blockage, patiently waiting, or communicating with siblings. Iowans also shared associations with telling a parent it is dangerous to enter the bin and beating on the outside of the bin. Lastly, academic major had some associations with scenario options. Agricultural Studies majors were strongly associated with choosing to patiently wait, whereas Animal Sciences students would communicate with their siblings.

Table 4.3. Adjusted Standardized Residual Analysis of Scenario #1: Personal Safety vs. Parental Authority and Pressure

	Gender	
Scenario #1 Options	Male	Female
Enter the grain bin to remove the blockage	3.0**	-2.0*
Tell your parent it is dangerous to enter the bin	0.8	2.1*
Use a pole to break up the blockage from outside the bin	3.4**	1.4
Wait five minutes to see if the blockage breaks down itself	0.7	1.8
	Age	
	18-21	22-33
Enter the grain bin to remove the blockage	1.3	0.0
Tell your parent it is dangerous to enter the bin	2.4*	0.3
Use a pole to break up the blockage from outside the bin	3.2**	1.9
Wait five minutes to see if the blockage breaks down itself	1.7	0.7
	State	
	Iowa	Non-Iowa
Enter the grain bin to remove the blockage	1.2	0.1
Tell your parent it is dangerous to enter the bin	2.7*	-0.5
Use a pole to break up the blockage from outside the bin	3.9**	1.1
Wait five minutes to see if the blockage breaks down itself	0.5	2.5*

	Academic Major				
	ABE	Ag Business	Ag Studies	Agronomy	Animal Science
Enter the grain bin to remove the blockage	1.4	2.3*	-0.7	0.0	-1.3
Tell your parent it is dangerous to enter the bin	-0.5	1.5	0.0	1.9	0.6
Use a pole to break up the blockage from outside the bin	2.1*	0.5	1.7	0.8	1.3
Wait five minutes to see if the blockage breaks down itself	-0.3	0.0	1.5	0.6	1.5

Note: *evidence of association; **evidence of strong association

Table 4.4. Adjusted Standardized Residual Analysis of Scenario #2: Personal Safety vs. Productivity

	Gender	
Scenario #2 Options	Male	Female
Call your neighbor to see how much longer they will be	1.0	1.5
Enter the bin to walk down the corn, potentially speeding up the unload	4.3**	-2.6*
Patiently wait for the grain to unload	2.8*	2.3*
Wait ten minutes and then check the progress of the unloading	-0.1	2.9*
	Age	
	18-21	22-33
Call your neighbor to see how much longer they will be	0.8	2.1*
Enter the bin to walk down the corn, potentially speeding up the unload	1.8	0.4
Patiently wait for the grain to unload	4.0**	1.1
Wait ten minutes and then check the progress of the unloading	2.4*	0.0
	State	
	Iowa	Non-Iowa
Call your neighbor to see how much longer they will be	0.8	1.8
Enter the bin to walk down the corn, potentially speeding up the unload	1.3	1.1
Patiently wait for the grain to unload	5.3**	-0.5
Wait ten minutes and then check the progress of the unloading	1.3	1.7

	Academic Major				
	ABE	Ag Business	Ag Studies	Agronomy	Animal Science
Call your neighbor to see how much longer they will be	0.1	1.4	-1.4	2.4*	0.7
Enter the bin to walk down the corn, potentially speeding up the unload	1.2	1.3	0.7	-0.2	0.1
Patiently wait for the grain to unload	1.3	0.4	3.5**	0.4	0.9
Wait ten minutes and then check the progress of the unloading	0.3	0.8	-0.2	1.3	1.4

Note: *evidence of association; **evidence of strong association

Table 4.5. Adjusted Standardized Residual Analysis of Scenario #3: Personal Safety vs. Sibling and Peer Pressure

	Gender	
Scenario #3 Options	Male	Female
Beat on the outside of the bin to break up the blockage	3.5**	0.2
Communicate the possibility of avalanched grain to your sibling	0.7	4.7**
Enter the bin to remove the blockage with your sibling	3.1**	-0.8
Wait a few minutes to see if the blockage breaks down itself	1.0	-0.2
	Age	
	18-21	22-33
Beat on the outside of the bin to break up the blockage	3.5**	0.3
Communicate the possibility of avalanched grain to your sibling	4.1**	0.9
Enter the bin to remove the blockage with your sibling	1.0	2.0*
Wait a few minutes to see if the blockage breaks down itself	0.3	0.7
	State	
	Iowa	Non-Iowa
Beat on the outside of the bin to break up the blockage	2.2*	1.8
Communicate the possibility of avalanched grain to your sibling	4.3**	0.8
Enter the bin to remove the blockage with your sibling	1.7	1.1
Wait a few minutes to see if the blockage breaks down itself	1.3	-0.5

	Academic Major				
	ABE	Ag Business	Ag Studies	Agronomy	Animal Science
Beat on the outside of the bin to break up the blockage	1.9	-0.7	0.7	3.3**	-0.3
Communicate the possibility of avalanched grain to your sibling	-1.4	2.2*	2.1*	0.3	3.5**
Enter the bin to remove the blockage with your sibling	1.8	1.3	0.7	0.3	-0.5
Wait a few minutes to see if the blockage breaks down itself	1.3	1.3	-0.5	-0.7	-0.2

Note: *evidence of association; **evidence of strong association

Factors Affecting Scenarios

A statistical analysis was adopted from Keren et al. (2006) to examine the significance of individual decision-making factors versus all other factors. The factors were arranged in the order they were most commonly ranked for each individual scenario. The calculation analyzed the number of times a certain factor was chosen in its most common placing versus the times it was chosen in all other placings. For example, the personal safety factor was ranked most commonly as first for Scenario #1. The analysis divided the number of times personal safety was chosen as first (n = 118) by the number of times personal safety was chosen as second, third, fourth, or fifth (n = 48). One was labeled the ultimate mean, which represented factors that were not prioritized more or less than other factors. If a value less than one was calculated, the factor was deemed less important than other factors. If a value greater than one was calculated, the factor was deemed of greater importance in relation to other factors. In the case of personal safety in Scenario #1, a value of 2.45 was calculated, indicating its importance over the other factors.

Scenario #1 analyzed personal safety versus parental authority and pressure. In addition to the personal safety factor, parental authority and pressure also calculated a value greater than one. This indicates the factors' importance over productivity, hazard level of the task, and likelihood of engulfment. In Scenario #2, which analyzed personal safety versus productivity, personal safety was the only factor to calculate a value greater than one. Therefore, personal safety is the only factor participants held of great importance in Scenario #2. Scenario #3 examined personal safety versus sibling and peer pressure. The factors of personal safety and sibling and peer pressure provided calculations that were greater than one, indicating their

greater importance over the remaining factors. Table 4.6 outlines the full analysis versus the ultimate mean.

Table 4.6. Analysis of Factors vs. Ultimate Mean

Scenario	Factor	Value
#1: Safety vs. Parental Authority	Personal Safety	2.45*
	Productivity	0.72
	Hazard Level of the Task	0.52
	Likelihood of Engulfment	0.69
	Parental Authority and Pressure	1.27*
#2: Safety vs. Productivity	Personal Safety	1.69*
	Productivity	0.82
	Hazard Level of the Task	0.64
	Likelihood of Engulfment	0.60
#3: Safety vs. Sibling/Peer Pressure	Personal Safety	1.70*
	Productivity	0.67
	Hazard Level of the Task	0.79
	Likelihood of Engulfment	0.58
	Sibling and Peer Pressure	1.70*

Note: * significant (value greater than the ultimate mean of 1)

A t-test analysis was also conducted to determine the significance of each factor's mean value with the assumed mean value. Because there were five factors to be ranked corresponding with Scenarios #1 and #3, the hypothesized mean value, or middle ranking value, was 3. In Scenario #2 however, which only had four factors to rank, the hypothesized mean value was 2.5. The significance level (α) = .001. A significant result indicated that the particular factor was prioritized more than other factors.

In Scenario #1, the factors of personal safety, productivity, and parental authority and pressure all yielded p-values less than .001, which indicated their importance over the factors of hazard level of the task and likelihood of engulfment (Table 4.7). Two factors yielded significant values for Scenario #2. They were personal safety and likelihood of engulfment (Table 4.8). Lastly, Scenario #3 yielded three significant p-values less than .001. The factors showing significant values were personal safety, hazard level of the task, and sibling and peer pressure (Table 4.9). Because all three scenarios exhibited t-test values showing that personal safety was significant, the factor was extremely important in respondents' decision-making.

Table 4.7. Testing Mean Values for Scenario #1: Personal Safety vs. Parental Authority and Pressure

Factor	Mean	Std. Deviation	t-Score	p-Level
Personal Safety	1.42	0.77	-26.444	.000*
Productivity	3.37	1.24	3.872	.000*
Hazard Level of the Task	2.78	1.11	-2.512	.013
Likelihood of Engulfment	3.25	1.12	2.908	.004
Parental Authority and Pressure	4.17	1.12	13.482	.000*

Note: N = 166; * significant at $\alpha = .001$

Table 4.8. Testing Mean Values for Scenario #2: Personal Safety vs. Productivity

Factor	Mean	Std. Deviation	t-Score	p-Level
Personal Safety	1.49	0.74	-16.500	.000*
Productivity	2.81	1.25	3.005	.003
Hazard Level of the Task	2.74	0.82	3.476	.001
Likelihood of Engulfment	2.96	0.91	6.142	.000*

Note: N = 148; * significant at $\alpha = .001$

Table 4.9. Testing Mean Values for Scenario #3: Personal Safety vs. Sibling and Peer Pressure

Factor	Mean	Std. Deviation	t-Score	p-Level
Personal Safety	1.59	0.89	-19.485	.000*
Productivity	3.36	1.31	3.438	.001
Hazard Level of the Task	2.53	0.91	-6.472	.000*
Likelihood of Engulfment	3.11	1.18	1.155	.250
Sibling and Peer Pressure	4.41	0.96	18.073	.000*

Note: $N = 154$; * significant at $\alpha = .001$

Discussion

Several findings transpired from this study. Research question 1 examined the role of parental supervision in youth safety-related decisions on the family farm. Results from Scenario #1, which analyzed personal safety versus parental authority and pressure, showed that participants in this study did not place parental authority over personal safety. Most often, individuals would choose not to enter the grain bin in this scenario, but rather find an alternative way to remain productive, wait until forced to act, or confront their parent.

When asked to rank the factors affecting their decision-making, most respondents held all other factors, including personal safety, in higher regard than parental authority and pressure. In the analysis of the factors versus the ultimate mean of one, parental authority and pressure yielded a significant value. The significance indicates this factor's extreme lack of importance to participants' decision-making process. Likewise, in the t-test analysis, parental authority and pressure again yielded a significant result with a p-value < .000. Since it was most commonly ranked last in terms of importance, there is strong evidence that survey respondents did not value parental authority and pressure in their decision-making. Due to the apparent lack of parental

influence in youth decision-making, it is questionable why youth enter grain bins on their family farms in the first place. Future research efforts should work to address this knowledge gap.

Research question 2 analyzed the factors that affected youths' decision-making. The factors were personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. From the survey results, it is evident that participants considered their personal safety. When analyzing the factors versus the ultimate mean of one, personal safety yielded a significant result for all three scenarios. Both results matched the findings of Mosher et al. (2014). The t-tests generated the same result – personal safety was significant in the decision-making processes for all three scenarios, meaning respondents highly value their personal safety.

The findings revealed differences among participants' choices according to their demographics, and additional research should continue exploring this concept. The younger population was much more likely to find alternative methods to remain productive instead of entering the bin. This population favored using a pole or beating on the outside of the bin to break up the blockage. The older population could have indicated more risk-averse behavior for various reasons, but it is speculated that the younger population may have a belief of invincibility.

Respondents from Iowa were strongly associated with the choices that were productive but did not require them to enter the grain bin. The data suggest that Iowans are familiar with the hazards associated with grain bins, which may lead them to resist unnecessary entry. This conclusion is plausible due to the heightened number of recorded grain entrapment cases that occurred in Iowa (Issa et al., 2016).

Moreover, academic major had random associations with respondents' decision-making. Agricultural Studies students were more likely to patiently wait for the grain to unload, whereas Animal Sciences students would communicate with others. Agricultural Business majors were likely to enter the bin. While the results cannot be definitively stated, they suggest some level of association between academic major and grain bin entry decision-making. Additional research should be conducted to gain more conclusive results.

Gender differences played a noteworthy role in youth safety-related decisions. In Scenarios #2 and #3, there was a significant difference between the decision-making of males and females. In both scenarios, males were more inclined to partake in higher-risk actions, like entering the bin, than females. Females were more likely to wait until forced to act or choose an alternative option that might not be as productive. The findings concur with previous research that determined females are more risk-averse than males (Lasenby-Lessard et al., 2013). The differences in responses per gender point to the need for parents to supervise their sons and daughters differently while working on the farm. Because boys tend to seek risk, they must be given extra precaution, safety briefings, and supervision as they complete farm work.

Aside from their decision-making and demographic associations, overall, participants were highly aware of grain entrapment hazards. The t-test result for Scenario #3 showed a significant value for hazard level of the task, indicating that respondents knew the hazards associated with the avalanched grain scenario. Similarly, Scenario #2's t-test produced a significant value for likelihood of engulfment. Therefore, respondents knew the dangers of walking down grain in Scenario #2 and thought there was a high likelihood that they may become engulfed in grain. Perhaps due to heightened media coverage in recent years, personal

experiences, or safety lessons from their superiors, participants knew the hazards associated with grain bin entry.

Because self-preservation was held in such high regard, and participants were well aware of the hazards, it is questionable why grain entrapment incidents continue to occur. Knowing the hazards does not always correspond with safely completing tasks. Undoubtedly, the factor of productivity plays a role in youth decisions, although the data suggests that participants did not hold the factor in high importance. The findings of this study point toward the need for additional research to understand more broadly the influencing factors in youth decisions regarding hazardous farm tasks.

Limitations

Several limitations of the study should be noted. Because participants were aware that the study was analyzing farm safety, they may have responded in a more risk-averse manner, causing response bias (Creswell, 2012). Social desirability bias is possible, as participants may have responded in socially appropriate ways instead of revealing their true stance (Grimm, 2010). To help combat this issue, the survey reminded participants that “There are no right or wrong answers,” and the researcher wanted to identify “How you would first react if you were in each situation.” Despite the reminder, it is possible that some students still provided biased responses.

The scenarios were intended to be as realistic as possible, however, they are hypothetical. A participant could have answered the scenario one way on the survey but a different way in person. Therefore, it is acknowledged that there could be a difference between what respondents reported they "might" do in a situation versus what they would "actually" do in a real-life situation.

Lastly, this study only surveyed students from one Midwestern university. The results cannot be generalized to other universities in the Midwest or the country. The researcher acknowledged this limitation before beginning the study. The study was intended to better understand the conditions in which youth interacted with and obeyed or disobeyed their parental "supervisors" on the farm.

Conclusion

Youth value their personal safety and are aware of hazards associated with grain bin entry. Factors of parental authority and pressure, sibling and peer pressure, and productivity do not influence youth decisions regarding grain bin entry. Though, it is still questionable why youth choose to make hazardous decisions involving grain bins.

Despite this study's findings, it is evident that there is much more to understand about youth decision-making in hazardous agricultural situations. Additional research should be conducted expanding the participant population to include a broader scope and adapting the survey instrument to include various agricultural tasks. There may be associations between participant demographics and decision-making, and this concept should also be explored through further research. A better understanding of the youth decision-making process would allow safety professionals to pinpoint the contributing factors in youth farm incidents and prevent their occurrence.

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Appendix. Survey Protocol – Understanding Parent Influences on Youth Decisions to Enter Agricultural Grain Storage Facilities

Invitation to Participate (Email)

Dear CALS student,

I am Kayla Walls and I am a master's student in Industrial and Agricultural Technology at Iowa State University. I am inviting you to participate in my research study about understanding parental influences on youth decisions to enter agricultural grain storage facilities. You are eligible for this study because you may have had prior experiences inside grain bins while you were under the age of 18.

To participate in this study, you will take a brief survey. You will then have the option to state your interest in a short follow-up interview. All randomly selected interviewees will be entered into a drawing to receive a $20 gift-card as compensation for their time.

This survey is voluntary and will take approximately 10 minutes to complete.

Follow this link to the survey: Take the Survey
Or copy and paste the URL below into your internet browser:
https://iastate.qualtrics.com/jfe/form/SV_41v8uFPBdzn69xj?Q_DL=0J1DmzKawnVMNwN_41v8uFPBdzn69xj_MLRP_82JvHXRGfVQmpKJ&Q_CHL=email

Follow the link to opt-out of future emails: Click here to unsubscribe

If you have any questions, please contact kwalls@iastate.edu.

Thank you,
Kayla Walls

Survey

Note: This survey was modified from the online format.

Understanding Parent Influences on Youth Decisions to Enter Agricultural Grain Storage Facilities

You are invited to participate in an online survey about the influence of parental pressure on youth's decision to enter grain storage facilities. This research project is conducted by Kayla Walls, a master's student at Iowa State University. It should take approximately 10 minutes to complete.

PARTICIPATION
Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty. You are free to decline to answer any particular question you do not wish to answer for any reason.

BENEFITS
You will receive no direct benefits from participating in this research study. Your responses may help us learn more about why youth choose to enter grain storage facilities and the role of parental supervision in these decisions. Finally, we will discover how the factors of safety expertise, knowledge of hazards, productivity, sibling and peer pressure, and parental pressure affect youths' decisions.

RISKS
There are no foreseeable risks from participating in this study.

CONFIDENTIALITY
Your survey answers will be sent to a link at Qualtrics.com, where data will be stored in a password protected electronic format. Your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study. At the end of the survey, you will be asked if you are interested in participating in an additional in-person interview. If you choose to participate in the follow-up interview, you will be routed to another survey where you can input your email address. Therefore, your responses to this survey will remain confidential and not linked with your contact information.

CERTIFICATE OF CONFIDENTIALITY
Identifying information gathered about you during this research project is protected by a Certificate of Confidentiality from the National Institute for Occupational Safety and Health. With this Certificate, researchers cannot be forced to share identifying information about you with anyone not connected to the research, even by a court subpoena. The researchers will use the Certificate to resist any court orders or legal demands.

Additionally, identifying information protected by the Certificate will not be shared outside of the research team, except in the following instances:

- If there is a law that requires disclosure (such as to report child abuse or communicable diseases, but not for legal or other similar proceedings);
- If you have consented to the disclosure or sharing of information, including any disclosure or data sharing plans described elsewhere in this consent document; or
- For use in other scientific research, as allowed by federal regulations protecting research subjects; or
- To personnel of the National Institute for Occupational Safety and Health, when information is needed for auditing or program evaluation; or
- To meet the reporting requirements of the Food and Drug Administration, such as for studies of investigational medical devices or drugs; or
- To authorized individuals at Iowa State University if they need to verify that the research is being done correctly.

Also, the researchers may share information if necessary to prevent serious harm to you or someone else; for example, if the researchers learn of ongoing child abuse or neglect, or the imminent threat of harm to you or others, they may share this information with the appropriate authorities.

You should know that a Certificate of Confidentiality does not prevent you from voluntarily sharing information about yourself or your involvement in this research. If you want your research information released to an insurer, medical care provider, or any other person not connected with the research, you must provide consent to allow the researchers to release it.

CONTACT
If you have questions at any time about the study or the procedures, you may contact the researcher, Kayla Walls, via phone at 419-305-1087 or via email at kwalls@iastate.edu.

If you feel you have not been treated according to the descriptions in this form, or that your rights as a participant in research have not been honored during this project, or you have any questions, concerns, or complaints that you wish to address to someone other than the investigator, you may contact the Iowa State University Institutional Review Board at 2420 Lincoln Way, Suite 202, Ames, Iowa, or email irb@iastate.edu.

1. **Electronic Consent**

Please select your choice below. You may screenshot a copy of this consent form for your records. Clicking on the "Agree" button indicates that:

- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older

○ Agree

○ Disagree *(Skip to end of survey if "Disagree" is selected)*

2. Have you had any experience within a metal grain bin on a family farm when you were **under the age of 18?**

○ Yes

○ No *(Skip to "You do not qualify for this survey" page if "No" is selected)*

3. Briefly describe why you were inside a metal grain bin on a family farm when you were under the age of 18.
    - examples: removing grain from the bin, playing in the grain, repairing machinery, walking down grain, etc.

_____

_____

_____

_____

_____

4. **Display Page:**

You will be presented with 3 different scenarios.

Please explain how you would first react if you were in each situation.
You will then be asked to rank how various factors played a role in your decision.

*** There are no right or wrong answers. ***

5. **SCENARIO #1:**
   You are working with your parent to unload a grain bin on your family farm when you notice the auger is moving less corn than before. Your parent suggests there may be a blockage of bad grain, and asks you to drop into the top of the bin to physically break up the obstruction while the auger continues running. Your parent agrees to supervise the auger.
   What is your next step?

   ○ Enter the grain bin to remove the blockage

   ○ Use a pole to break up the blockage from outside the bin

   ○ Wait five minutes to see if the blockage breaks down itself

   ○ Tell your parent it is dangerous to enter the bin

6. **SCENARIO #2:**
   Your neighbor agreed to help you unload corn from your bin when she gets home from work at 4:00 PM. The local elevator closes at 5:00 PM, and you need to take in your final load of the season to complete your contract. You figure you can at least start without your neighbor's help, and as the clock is ticking, you think about entering the bin to walk down the corn for quicker loading.
   What is your next step?

   ○ Call your neighbor to see how much longer they will be

   ○ Wait ten minutes and then check the progress of the unloading

   ○ Enter the bin to walk down the corn, potentially speeding up the unload

   ○ Patiently wait for the grain to unload

7. **SCENARIO #3:**
   You have a sibling of the same gender and similar age. You are both working to unload a grain bin when you learn there is moldy corn caked on the side of the bin from top to bottom. Your sibling offers to enter the bin to break up the moldy corn they can reach with a shovel. Your sibling suggests you turn off the auger and help him/her break up the blockage.
   What is your next step?

   ○ Beat on the outside of the bin to break up the blockage

   ○ Communicate the possibility of avalanched grain to your sibling

   ○ Enter the bin to remove the blockage with your sibling

   ○ Wait a few minutes to see if the blockage breaks down itself

8. **Recall the scenario below:**
   You are working with your parent to unload a grain bin on your family farm when you notice the auger is moving less corn than before. Your parent suggests there may be a blockage of bad grain, and asks you to drop into the top of the bin to physically break up the obstruction while the auger continues running. Your parent agrees to supervise the auger.

   Use your cursor to select and move (drag & drop) the following factors in terms of importance as to how you answered the previous scenario. Order the factors from your highest priority (#1) to your lowest priority (#5).

1	Personal safety
2	Productivity
3	Hazard level of the task
4	Likelihood of engulfment
5	Parental authority/pressure

9. **Recall the scenario below:**
   Your neighbor agreed to help you unload corn from your bin when she gets home from work at 4:00 PM. The local elevator closes at 5:00 PM, and you need to take in your final load of the season to complete your contract. You figure you can at least start without your neighbor's help, and as the clock is ticking, you think about entering the bin to walk down the corn for quicker loading.

   Use your cursor to select and move the following factors in terms of importance as to how you answered the previous scenario. Order the factors from your highest priority (#1) to your lowest priority (#4).

1	Personal safety
2	Productivity
3	Hazard level of the task
4	Likelihood of engulfment

10. **Recall the scenario below:**
    You have a sibling of the same gender and similar age. You are both working to unload a grain bin when you learn there is moldy corn caked on the side of the bin from top to bottom. Your sibling offers to enter the bin to break up the moldy corn they can reach with a shovel. Your sibling suggests you turn off the auger and help him/her break up the blockage.

    Use your cursor to select and move the following factors in terms of importance as to how you answered the previous scenario. Order the factors from your highest priority (#1) to your lowest priority (#5).

    [1] Personal safety

    [2] Productivity

    [3] Hazard level of the task

    [4] Likelihood of engulfment

    [5] Sibling/peer pressure

11. What is your gender?

    ○ Male

    ○ Female

    ○ Prefer not to answer

    ○ Other: _____

12. What is your age?

- ○ 18
- ○ 19
- ○ 20
- ○ 21
- ○ 22
- ○ 23
- ○ 24
- ○ 25
- ○ 26
- ○ 27
- ○ 28
- ○ 29
- ○ 30
- ○ 31
- ○ 32
- ○ 33
- ○ 34
- ○ 35+

13. Which U.S. state are you from?

▼ Alabama (1) ... N/A - I am not from the United States (51)

14. Which county in your state are you from?

_____

15. What is your academic major?

_____

16. While **under the age of 18**, were you ever entrapped or engulfed in grain in which you needed assistance to be rescued?

- ○ Yes
- ○ No *(Skip to question 20 "Thank you for taking the time…" if "No" is selected)*

17. Which year did the grain entrapment or grain engulfment incident occur?

- ○ 2019
- ○ 2018
- ○ 2017
- ○ 2016
- ○ 2015
- ○ 2014
- ○ 2013
- ○ 2012
- ○ 2011
- ○ 2010
- ○ 2009
- ○ 2008
- ○ 2007
- ○ 2006
- ○ 2005
- ○ 2004
- ○ 2003
- ○ 2002
- ○ 2001
- ○ I don't remember

18. How old were you at the time of the grain entrapment or grain engulfment incident?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 11
- ○ 12
- ○ 13
- ○ 14
- ○ 15
- ○ 16
- ○ 17
- ○ 18
- ○ I don't remember

19. If you wish, briefly describe the situation which led you to become entrapped or engulfed in grain.

_____

_____

_____

20. Thank you for taking the time to complete this survey! The researcher would like to conduct follow-up interviews that will last less than fifteen minutes. Participants will be randomly selected to participate in the interview. All participants who are selected to interview will be entered into a drawing to receive a $20 gift-card for their participation.

    Would you be willing to be contacted for a short face-to-face interview with the researcher?

    ○ Yes

    ○ No *(Skip to end of survey if "No" is selected)*

21. In order to prevent your contact information from being connected to your survey answers, please click this link to provide the researcher with the best email address you can be contacted at: https://iastate.qualtrics.com/jfe/form/SV_eycmxEODPO5IheZ

22. What is the best email address for the researcher to contact you if you are randomly selected to be interviewed?

    _____

CHAPTER 5. A QUALITATIVE APPROACH TO GRAIN BIN ENTRY DECISIONS BY YOUTH

Modified from a manuscript under review in *Journal of Agromedicine*

Kayla N. Walls & Gretchen A. Mosher
Department of Agricultural and Biosystems Engineering, Iowa State University

Abstract

Youths – defined as children under the age of 18 – are frequently involved in agricultural work. Parental assignment, briefing, and supervision of hazardous farm tasks have an influence on youth safety, yet many youths are injured or killed performing these tasks. This research utilized a qualitative approach to analyze why youth choose to make hazardous decisions regarding grain bin entry and factors that played a role in youth decisions. Ten students who attended a Midwestern land-grant institution were interviewed. Interviewees had experience working inside grain bins, were highly involved in their family farming operations while under 18 years old, and worked under frequent parental supervision. Interviewees shared conditions where they followed their parents' orders even when they knew the task was unsafe. Moreover, participants also indicated when they would refuse orders from parents. Findings showed that the primary source of agricultural safety knowledge came from the interviewees' parents. Interviewees did not demonstrate a "blind trust" in their parents, as they were not willing to follow all orders they were asked to complete. However, all interviewees indicated that their parents would not ask them to do anything unsafe. Many barriers to farm safety were emphasized by the interviewees, which may contribute to youth choosing to make hazardous decisions regarding grain bin entry under some conditions. The research implications are emphasized relative to youth safety outcomes on family farms.

Introduction

Nearly 893,000 youth live on a farm in the United States (NIOSH, 2018). Historically, youth have been heavily involved with their farming operations (Effland, 2005), as over half of the youth living on farms also participate in farm work (2018). With the considerable number of youth workers in agriculture, there are also many injuries and fatalities among this population. Approximately 33 children are injured in an agriculture-related incident each day (NIOSH, 2016), and agriculture incidents average one child fatality every three days (Perritt et al., 2017).

Compared to all other industries, the injury and fatality rate of youth workers in agriculture far exceed the average rates. Between 1992 and 2002, the fatality rate of young agricultural workers was 3.6 times the rate of young workers across all industries, and 2.9 times the rate of all workers across all industries (Hard & Myers, 2006). Since 2009, the youth worker fatality rate in agriculture has exceeded all other industries combined (NIOSH, 2019).

Some argue that the nature of farm work is inappropriate for youth (Effland, 2005). Consequently, the federal government created child labor laws to help minimize the effects of work on young employees' health and welfare (Miller, 2012). The Hazardous Occupations Orders for Agriculture contains eleven hazardous tasks considered too dangerous for youth under 16 years old to complete. There are exemptions to this rule, however, as youth who work on farms owned or operated by their parents are permitted to perform any task (U.S. Department of Labor, 2007).

Parent Supervision of Farm Tasks

Parents regularly supervise their youth as they complete agricultural work (Jinnah & Stoneman, 2016). In half of youth injury cases, the injured youth was under the surveillance of an adult performing farm work nearby (Wright et al., 2013). This fact debunks a myth believed by parents that keeping their children close to them will keep them safer (Summers et al., 2017).

Parents often think that safety is “common sense” (Summers et al., 2017), not recognizing that their own knowledge and life experiences contribute to their so-called “common” safety sense.

Youth are socialized to understand that parents have authority over their children (Deutsch & Jones, 2008). A strong predictor of child obedience to adult orders is a preexisting relationship between the adult and the child (Landauer et al., 1970). Based on these findings, it is expected that youth who have a strong relationship with their parents would obey most orders. However, when analyzing the parent-youth supervisor-employee relationship in an agricultural setting, one study determined that youth value their personal safety over parental authority and pressure (Walls & Mosher, 2020). Therefore, despite having a strong relationship, youth may refuse their parents’ orders when asked to complete an unsafe farm task. The researcher examined this phenomenon by studying youth decision-making.

Decision-Making

The Theory of Cognitive Dissonance explains the relationship between two or more contradicting cognitions, which causes an uncomfortable state of mind (Festinger, 1957). When a person encounters a case of contradicting cognitions, they will attempt to resolve this conflict quickly to reduce the mind’s uncomfortable state (Mosher et al., 2013). This theory can be applied to agriculture when a worker will use any prior knowledge, perhaps contradicting, to resolve a conflict. There are three ways which an employee could address a conflict in a safety scenario: (1) ignore their own judgment and obey the leadership, (2) ignore the leadership and follow their own judgment, or (3) delay the decision until they are forced to act (Das et al., 2008).

Adolescent workers are more likely to conform to the authority’s rules (Bronfenbrenner, 1970**)**. Westaby and Lowe (2005) found that when the authority is stern about not taking risks while working, employees are less likely to take risks. The same assumption can be made about

young agricultural workers under parental supervision. If parents are stern about not taking risks while completing farm work, it is expected that youth will be more mindful of their safety.

Piaget's Stage Theory of Cognitive Development states that individuals are unable to think abstractly until they reach the final stage of cognition between 12 and 18 years old (Huitt & Hummel, 2003). Before reaching this threshold, youths' risk-assessment skills may be inadequate in potentially hazardous situations. If a youth was assigned a potentially hazardous farm task by their parent at a young age, they may be unable to reason and make safe decisions.

This research's central hypothesis was that the approach parents take to the supervision of hazardous tasks plays a role in youth safety outcomes on family farms. Youth decision-making was analyzed through the lens of one hazardous farm task: grain bin entry. This study was aimed to improve understanding of the decision-making processes of youth who enter grain bins. Qualitative data were collected in response to two research questions:

1. Why do youth choose to make hazardous decisions regarding grain storage facilities?
2. What factors play a role in youths' decisions to enter grain bins?

Methods

The methodology followed Merriam's basic qualitative research design (2016). Because qualitative research is based on the underlying theory of social constructivism, this study sought to "Understand how people make sense of their lives and their experiences" (Merriam, 2016, p. 24). Creswell (2009) stated that social constructivism is a suitable theoretical framework when the analysis reveals how individuals interact with their world. This research sought to explore youths' social constructivism to make sense of their experiences completing a hazardous farm task while under parent supervision. This approach was deemed appropriate due to the anticipated differences in participants' interactions with grain bins and parent supervision.

The study population was students at a Midwestern land-grant university enrolled in selected academic departments within the College of Agriculture and Life Sciences. Participants self-disclosed prior experiences working inside grain bins while under 18 years old. A convenience sample was obtained from the population within the College of Agriculture and Life Sciences (approximately 2,700 students) as participant recruitment was self-nominating (Creswell, 2012). Participants who indicated an interest in completing an interview received a short Qualtrics®^{XM} survey. The researcher selected interviewees according to their survey responses. Selected interviewees were highly involved in their family farms and were often supervised by their parents. The researcher did not intend to generalize the results to a greater population, but rather, describe the interviewee population in great detail.

Interviews were conducted using WebEx™ which allowed for a virtual "face-to-face" interview experience. Participants provided written consent to audio-record the conversations for transcription purposes. Interviewees were promised anonymity in the interview analysis and report, and participant confidentiality was maintained throughout the study. The researcher facilitated a semi-structured interview process (Merriam, 2016), where participants shared their experiences working on the farm under parent supervision. Participants also explained the conditions under which they would obey or refuse a parent's orders to complete an unsafe farm task. All interview participants were awarded a $20 gift card as an incentive for their participation.

Triangulation methods were utilized by comparing participants' interview responses to their survey responses, which helped increase internal validity (Denzin, 1978). Because the interviews were audio-recorded, the researcher simultaneously collected and analyzed the data. The researcher conducted member checks to the successive interviews to help interpret

preliminary findings (Merriam, 2016). The researcher transcribed the audio-recorded files after each interview and assigned codes for emerging themes based on the study's two research questions. Using the constant comparison method (Glaser & Strauss, 1967), interviews proceeded until saturation was reached for the main themes.

Results

Forty students participated in the survey and ten interviewees were selected based on their responses. Table 5.1 shows the interviewee demographics. Per the two research questions, five themes emerged from the interviews (1) parents provide youth with farm safety knowledge, (2) farm parents and youth have a unique supervisor-employee relationship, (3) farm youth trust their parents, (4) youth value their personal safety, and (5) there are barriers to farm safety.

Table 5.1. Demographics of Interview Participants

Interview Number	Sex	State of Residence	Involvement in Farm Operation	Times in Grain Bin as Youth	Parent Supervision
1	Female	Iowa	Always	20+ times	Most of the time
2	Male	Iowa	Always	20+ times	About half the time
3	Male	Iowa	Most of the time	16-20 times	Always
4	Male	Iowa	Most of the time	20+ times	Most of the time
5	Male	Illinois	Most of the time	20+ times	Always
6	Female	Iowa	Always	20+ times	Most of the time
7	Male	Virginia	Always	20+ times	Most of the time
8	Female	Iowa	Some	20+ times	Always
9	Female	Iowa	Most of the time	20+ times	Always
10	Male	Iowa	About half the time	20+ times	Most of the time

Parents Provide Youth with Farm Safety Knowledge

Participants shared diverse sources of farm safety knowledge, including Farm Safety Days, personal experiences from growing up on the farm, and hearing stories about traumatic incidents. However, most participants claimed to have learned about farm safety from their parents, specifically their fathers. Some participants told short stories about how their parents would brief them on safety concerns before beginning farm tasks. When asked where she learned about farm safety, Participant 1 explained, "My dad taught me everything I know…I would be running around with him as like a little 5-year old…and he was always teaching me then…My dad is a really good teacher telling us the dos and don'ts." Some participants reiterated personal quotes from their parents. Participant 5 quoted his father:

> I would say 99% [of farm safety knowledge] has come from my dad and just him always saying, "There's no reason to be scared of any work that you do on a farm. No matter if we're climbing a silo or we're getting in a grain bin, or we're doing whatever." He said, "Never be scared of it, but you always have to respect what could happen."

Emphasizing the understanding of "what could happen" was mentioned by several participants as methods their parents used to share safety information. Specific to grain bins, parents were generally the information source. Participant 5 noted, "My dad always equated working in grain bins to working with cows. The fastest way is to do it slow. Because if you get in a rush, you're going to screw something up." Other parents used scare tactics to ensure their youth were safe. Participant 4 shared his experience receiving briefings before completing tasks. He recalled, "Before we even start, [my parents] were going to get me introduced to what could happen, maybe even to scare me a little bit so I am a little safer I guess on my own. And that worked." Participant 4 believed the scare tactics positively influenced his safety:

> As I got older, you…start to hear stories about things like that happening. Where a guy was wearing a loose sweatshirt or something and he got caught in a PTO and his arm was pulled off, or things like that. And that's where you really get to see the reality of, "Oh, that's why [my parents] told me that before I even started doing that."

Parents play a role in how youth learn about farm safety and this theme emerged very clearly from the interviews. A second theme was the unique supervisory relationship that forms between farm youth and their parents.

Farm Parents and Youth Have a Unique Supervisor-Employee Relationship

The supervisor-employee relationship at a workplace parallels the relationship between farm parents and their youth. In terms of refusing orders given by superiors, Participant 3 admitted, "I guess from personal experience, usually disagreements don't always go over very well…they're kind of the boss, you know, you do what you're told." Interviewee 2 related this point to how he was raised to respect authority. Despite later indicating that he and his father did not have the best relationship, he stated:

> Being from the Midwest…If your parent or employer tells you to do something, most of us are raised to kind of just do it. Or do something in order to move towards that goal, regardless if you're following their direct action or not. But telling them "no" is pretty strong.

Participant 5 considered the parent-child relationship and the challenges of opposing orders to complete hazardous tasks. He revealed, "I feel like that's a lot more uncomfortable for a kid to tell their mom or dad like, 'Yeah, I don't want to. It's dangerous.'" Participant 8 agreed, citing the early age many youths begin their work on the farm. She mentioned, "Most people start working on the farm when they're pretty young, so I don't think like straight up telling your parent that, 'I'm not going to do that' is very common in any case." Participant 4 joked about

completing farm tasks to avoid being reprimanded, saying, “Maybe with a little bit of fear from, ‘Oh shoot, what’s dad going to say if we can’t get this stuff done on time?’”

Nearly all interviewees stated that their parents had never asked them to do something unsafe or uncomfortable. Nonetheless, participants were adamant that if their parents did ask them to do anything unsafe, they would refuse orders. Participant 2 asserted, “I don’t have any problems with disagreeing with [my dad] and telling him ‘no’…but I don’t remember any time that I specifically had to tell him ‘no.’” Participant 1 had a similar experience with her father. She claimed she would openly refuse dangerous orders, declaring, “If it’s too dangerous to enter the bin, and if dad’s yelling at me to go enter the bin, …I would be like, ‘No I’m not going in there.’”

Two female participants explained that they would refuse to follow parent orders if they felt incapable of completing the task or fearful of the task. Participant 8 explained, “If I ever expressed like, fear, or anything like that, like if I was scared, then [my dad] would…change his mind.” She later shared, “I wasn’t…capable of doing it. Like, I wasn’t strong enough a lot of the time to lift the auger…I was telling [my dad] like, ‘I can’t do that…You’re gonna have to come in and do that…because I can’t lift it up.’” Participant 6, who also works with her father on the farm, agreed that she would refuse orders if she did not feel like she had the appropriate skill level. When asked under which conditions she would deny her parents’ instructions, Participant 6 answered:

> Something that I didn’t feel like I was cable of doing. Like that was above my skill level, maybe…Sometimes [my dad] expects me to do stuff that I either don’t know how to do or don’t feel like I have the strength to do.

As part of the supervisor-employee relationship, farm youth hold a certain level of trust in their parent. The third theme discusses this trust and how it may influence youth obedience or refusal of parental orders.

Farm Youth Trust Their Parents

Nearly all interviewees declared that their parents would not ask them to do anything that their parents would not do themselves. Participant 6 described her parents as "even-keeled," later mentioning, "I wouldn't be blatantly disobedient to my parents, but I also don't think that they would tell me to do something that they didn't see themselves doing." Participant 8 shared a similar anecdote, "I trust my dad a lot. And I know that he would always…put himself more at risk than me." She later noted, "You just trust your parents and you do what they tell you."

Finally, Participant 7, who has asthma, shared that his father typically enforced him wearing a respirator while completing dusty farm work. He told about one time the respirator was overlooked, yet he continued trusting his father:

> There are a few times…we were rushed…pulling corn out of the bin…I wouldn't have a mask on and I would say, "Hey dad, shouldn't I have a mask on?" He would say, "No, no, no, that's fine. We're not gonna be here that long." You know, I trusted him…I mean, I'm still here living to tell about it today.

There was strong evidence that interviewees trusted their parents. However, this was not "blind trust" – youth would first consider their safety. A fourth theme discusses the value youth hold in their personal safety.

Youth Value Their Personal Safety

Despite the parental influence, interviewees consistently held personal safety in high regard. Participant 7 stated, "I mean, everybody wants to be safe, or everybody wants to think that they're being safe." Likewise, Participant 10 reported, "People at their core are wired for

self-preservation. Nobody wants to get hurt while they are working and are always weighing the risks." Personal safety was especially of concern while working with grain bins. Participant 6 expressed, "Obviously safety is important when entering grain bins and anything to do with grain bins."

Personal safety was explicitly held in higher regard than productivity. Participant 9 claimed, "You have to be safe first in order to have your productivity." Participant 1 equated productivity with injury. She noted, "You can't be productive if you're sitting in the hospital bed." Participant 8 prioritized her safety over productivity during busy times. She asserted, "People are just more concerned about their safety than…taking that last load in."

Even while working with others, personal safety remained the chief priority. When asked about working under a supervisor, Participant 8 stated, "You always want to…do what you're told to do…and there's a certain point when your personal safety, your own life, kind of overtakes that." Participant 7 emphasized that farmers want to stay safe and healthy. He remarked, "Everybody wants to be safe. Nobody wants to get hurt. Nobody wants to see somebody that they care about get hurt."

Although individuals may value their personal safety, there are still barriers to remaining safe on the farm. The final theme discusses several barriers to farm safety stressed by interviewees.

There are Barriers to Farm Safety

Farming poses unique, uncontrollable hazards that make it unsafe. It is a career with low control and high demand – farmers have little control over certain success factors, like weather and market prices, yet farming requires a high demand of capital and labor. Interviewees mentioned the cost of safety, such as personal protective equipment, engineering controls, and

administrative controls. Participant 10 stressed, “It costs a lot of money to implement safety things.”

There are certain agricultural seasons when productivity is essential. Participant 8 noted, “When things get really busy during planting or harvesting…people don’t want to take…the safety precaution for something because they just want to get it done.” Regarding an example of a time where rushing might be warranted, Participant 2 described, “If you were hauling corn and you had a blockage, and you maybe wanted to take more time to kind of resolve that issue safely, but you knew rain was coming.” Some participants mentioned that rushing was often a cause of incidents. Participant 4 explained:

> Someone knows that there’s a shortcut available that’s not the correct way to do something, but because they’re trying to get something done, you know, before the weather comes in, before the sprout comes in, or so they can make it to an appointment in town, whatever it might be, everything is kind of regarded around the emphasis of time. And so, when that becomes an issue, that’s when I think accidents start to happen.

Many interviewees attributed a lack of employees as a safety barrier. Participant 5 mentioned, “Not having enough people around…so you gotta do something yourself or…nobody there to watch over you. Nobody there to make sure everything goes smoothly…a lot of guys have to be independent.” Specific to working inside grain bins, Participant 6 expressed, “I think that being alone is really dangerous, and when you’re alone, I think that productivity kind of takes a back seat to being safe.” Participant 5 shared that working with others manages farmers’ stress. He reasoned, “Just the thought of somebody else being there would make you feel better. And you know if you’re under less stress, you’re going to make less mistakes usually.”

Lastly, many participants mentioned the farmer's false sense of security and the thought that an incident would not happen to them. Participant 7 stated from personal experience, "I consider myself a safe person, but you know, there's always that one time where you're like, 'Oh, it doesn't matter this time…We'll make it work and we'll just go ahead and do something maybe that's not the safest.'" The same interviewee later noted, "That mindset of, 'Maybe this one time I'll be…alright, you know, nothing's gonna happen to me.'" Participant 8 had a similar theory, stating, "The mindset of…well, 'Oh, it won't happen to me.' And so just knowing that you're doing something dangerous but, like, trusting yourself and thinking that'll be okay."

The many barriers to farm safety may entice workers to disregard their personal safety. The following section discusses the implications of these findings and what they may mean for youth safety outcomes on family farms.

Discussion

The first research question asked why youth choose to make hazardous decisions regarding grain bin entry. Based on the interview dialogue, participants were aware of the hazards in grain bins. However, several barriers to remaining safe on the farm were mentioned, including the cost to implement safety measures. Additionally, farmers often have to work alone, and the lack of a "buddy system" heightens the risk. Multiple interviewees commented on the "It won't happen to me" attitudes of some farmers, and some participants even spoke from personal experience about having this attitude. Lastly, during planting and harvest seasons or with incoming inclement weather, interviewees stressed the need for productivity.

Despite these factors influencing personal safety, most interviewees indicated that they would choose a safe option if faced with a potentially hazardous situation in real life. Many also agreed that parental authority and pressure played little role in their decisions, as they would openly refuse their parents' orders if they knew the situation was unsafe. Overall, interviewees

claimed to know the hazards, value their personal safety, and refuse unsafe supervisor orders. If all these statements are true, the question remains as to why youth choose to make hazardous decisions regarding grain bins.

The second research question asked which factors played a role in youth grain bin entry decisions. Nearly all interviewees credited their parents for teaching them about farm safety. Therefore, parents must actively assume the role of "safety instructor" and not assume that their children know the hazards. Since parents serve as a supervisor while their youth complete work, they undoubtedly influence youth entry into grain bins. The results from this study indicate that if a parent asked their youth to enter a grain bin, and the youth thought the situation was safe, they would likely enter.

Youth have a trust in their parents and think that they would not ask the youth to do anything that their parents would not do. Although not evidenced by interviewees in this study, the trust could be blinding. If youth are unaware of the hazards yet trust their parents, they may be willing to complete any farm task, even if unsafe. Because youth have limited life experience, parents must explicitly brief the youth of the hazards before allowing them to begin a new task. Youth should only be assigned age-appropriate tasks and only work under direct supervision.

Preceding this study, research found that youth prioritize their personal safety above parental authority and pressure (Walls & Mosher, 2020). While these findings were fairly supported in this study, some interviewees provided contradicting insights. The in-theory versus in-use practice should be considered. What a participant says they "might" do in a situation may differ from what they would "actually" do. Some participants declared that they would refuse any unsafe orders from their parents, but also said they were raised to respect authority and could not imagine refusing a direct request from their parent. Participants also acknowledged that their

parents had not asked them to do anything unsafe on the farm, so they have never had to refuse orders. Further research should be conducted to explore this concept in an agricultural setting. The research should study the precise conditions under which a youth would refuse an order that they felt was unsafe.

Conclusion

Parent supervision of hazardous tasks has an impact on youth safety outcomes on family farms. Parents are credited as the primary source of farm safety knowledge to their children. Because safety is a learned behavior, farm safety conversations cannot be overlooked. Based on interview dialogue, successful methods in disseminating farm safety knowledge are briefings before completing a task, demonstrating technique, or sharing stories about what could happen as a scare tactic.

However, it must be acknowledged that although youth are aware of the hazards and claim to value personal safety, some youth may still choose to complete dangerous tasks without taking safety precautions. Several general barriers to remaining safe on the farm were emphasized but normalizing the act of taking time to think through next actions is vital to youth workers' safety. Parental assignment of age-appropriate tasks, explicitly sharing safety messages with their youth, and teaching youth to value personal safety will positively impact youth safety outcomes on the family farm.

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Appendix A. Survey Protocol – Interviewee Selection Criteria

Invitation to Participate (Email)

Dear _____,

Thank you so much for your interest in a follow-up interview for the youth grain bin study! Due to an overwhelming response, I ask that you take less than 1 minute of your time to respond to a brief follow-up survey.

Due to the circumstances of virtual classes through the remainder of the semester, you will be able to mark how and when you would like to interview. No matter your preference, you will soon hear from me again stating if you were selected for an interview. All interviewees will receive a $20 gift-card as compensation for their time.

Follow this link to the survey: Take the Survey
Or copy and paste the URL below into your internet browser:
https://iastate.qualtrics.com/jfe/form/SV_41v8uFPBdzn69xj?Q_DL=0J1DmzKawnVMNwN_41v8uFPBdzn69xj_MLRP_82JvHXRGfVQmpKJ&Q_CHL=email

Follow the link to opt-out of future emails: Click here to unsubscribe

Please let me know if you have any questions. Thank you again for your interest in this project and I look forward to hearing from you soon!

Thank you,
Kayla Walls

Survey

1. Did you grow up living on or working on a family farm?
   - ○ Yes
   - ○ No *(Skip to end of survey if "No" is selected)*

2. Briefly describe the farm operation.

   _____

   _____

   _____

3. Rank your involvement with the farm operation while you were under the age of 18.
   - ○ Never
   - ○ Some
   - ○ About half the time
   - ○ Most of the time
   - ○ Always

4. Estimate the amount of times you have been inside a grain bin while you were under the age of 18.
   - ○ 0-5 times
   - ○ 6-10 times
   - ○ 11-15 times
   - ○ 16-20 times
   - ○ 20+ times

5. Rank how often your parent served as your direct supervisor while you were working inside or around grain bins.

   - ○ Never
   - ○ Sometimes
   - ○ About half the time
   - ○ Most of the time
   - ○ Always

6. Rank how often you have worked inside or around grain bins with siblings or peers.

   - ○ Never
   - ○ Sometimes
   - ○ About half the time
   - ○ Most of the time
   - ○ Always

7. Due to the COVID-19 situation, we are at a crossroads with how to proceed with interviews. Please rank your preference (with 1 - highest preference, and 3 - lowest preference) with how you would prefer to interview if you are selected.

1	Virtual interview during Spring 2020
2	In-person interview during Summer 2020
3	In-person interview during Fall 2020

Appendix B. Interview Protocol

Initial Email Offering Participation

Good afternoon _____,

Thank you again for your interest in my master's thesis and your participation in the surveys. If you are willing, I would love to interview you!

Here is a little bit about how the process would go:

1. You provide me with dates and times over the rest of the week and next week that work for a 15 to 20-minute virtual interview and we schedule a time. Interviews will take place over WebEx™.
2. You return a signed copy (print, sign, and scan or else sign electronically) of the Audio-Recording Consent Form (attached - more details in document). The interviews must be audio-recorded so I can transcribe them for my research.
3. We conduct the interview.
4. You provide me with an address, or we can set up a time to meet in person to exchange your $20 gift card. Let me know if you do not feel comfortable with this.
5. Upon receiving your gift card and per Iowa State requirements, you will sign a document titled Property Receipt Form (sign electronically or print, sign, and scan).

For now, if you are interested, please give me a few days and times that work best for a WebEx™ interview and sign the attached Audio-Recording Consent Form.

As always, please let me know if you have any questions - I look forward to hearing back from you!

Thank you,
Kayla Walls

Audio-Recording Consent Form

CONSENT TO AUDIO- RECORDING & TRANSCRIPTION

Understanding Parental Influences on Youth Decisions to Enter Agricultural Grain Storage Facilities
Kayla Walls, Master's Student in Industrial and Agricultural Technology
Iowa State University

This study involves the audio recording of your interview with the researcher. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. Only the research team will be able to listen to the recordings.

The tapes will be transcribed by the researcher and erased once the transcriptions are checked for accuracy. Transcripts of your interview may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor any other identifying information (such as your voice) will be used in presentations or in written products resulting from the study.

By signing this form, I am allowing the researcher to audio or video tape me as part of this research. I also understand that this consent for recording is effective until the following date: December 1, 2020. On or before that date, the tapes will be destroyed.

Participant's Signature: _____ Date: _____

Read Pre-Interview Statement to Participants:

"Thank you for being available to interview today. Because of your input, we will be better able to determine the factors which drive youth to enter grain bins. During this interview, you will be asked general questions about the survey you took several weeks ago, as well as your personal experiences working inside and around grain bins. Feel free to tell short stories about yourself, your family, or people you know, however, please do not share any names or other identifying information of these individuals. This interview will remain confidential. I may refer to you using your first name during the interview, but know that your name, email, voice, or other identifying information will NOT be reported for my master's research. During my write up of the interviews, you will be referred to as 'Interview Participant X.'

We are about to start the interview. Do I have your permission to audio-record the interview?"

Interview Questions

1. Reread Scenario #1. Most (56%) of your peers that completed this survey answered Scenario #1 saying they would use a pole to break up the blockage from the outside of the bin. Why do you think that was the most popular answer?

2. Why do you think Answer D, "Tell your parents it is dangerous to enter the bin" was not a very popular answer?

3. If you remember, after you were presented with each scenario, you were then presented with questions where you had to drag and drop factors in terms of your highest priority to your lowest priority. These five factors are listed in order as they were presented on the survey. Most survey respondents kept personal safety at the top as their highest priority. And they also kept parental authority and pressure at the bottom as the least important or their lowest priority. Why do you think that participants ordered these factors in that way?

4. Reread Scenario #2. Most (44%) of your peers that completed this survey answered Scenario #2 saying they would patiently wait for the grain to unload. Why do you think that was the most popular answer?

5. In Scenario #2, respondents again kept personal safety as their highest priority, but productivity took a fall in this scenario as a less important factor that affected their decision-making. Why is productivity not as important in this scenario?

6. Reread Scenario #3 – 36% of your peers answered Scenario #3 saying they would communicate the possibility of avalanched grain to their sibling and 35% of your peers said they would beat on the outside of the bin to break up the blockage. Why do you think your peers answered in these two ways?

7. For the third time, your peers kept personal safety at the top as the highest priority. For Scenario #3, they put sibling and peer pressure as the lowest priority. Why do you think your peers held sibling and peer pressure in such low regard in this scenario?

8. One interesting observation about Scenario #3 was that respondents ranked hazard level of the task as second. So, why do you think that people ranked hazard level of the task in such high priority in this scenario, where there is a potential for avalanched grain, but not the other two scenarios, where there is a potential for entrapment or engulfment?

9. Briefly describe the most recent situation when you entered a grain bin (examples: time of year, crop condition, why entry was necessary, etc.).

10. Describe safety precautions you took, if any, before entering the grain bin.

11. Have you ever been in a situation where your own parent was your supervisor while working around a grain storage and handling facility? If so, describe the situation(s).

12. Under what conditions would you follow your parent's directions even if you knew the situation was unsafe?

13. Under what conditions would you refuse to follow your parent's directions until you could complete the task safely?

14. Do you work with any siblings or peers on the farm?

15. Under what conditions would you follow your sibling's directions even if you knew the situation was unsafe?

16. Under what conditions would you refuse to follow your sibling's directions until you could complete the task safely?

17. Generally speaking, what are the largest obstacles to complete tasks safely on the farm?

Property Receipt Form

Iowa State University
Property Receipt Form

The purpose of this form is to provide a written acknowledgement from the recipient for property given by Iowa State University (ISU) for purposes *other than* the compensation of research participants. Research participants need to sign the Research Participant Receipt Forms specifically designed for that purpose.

If the **property (cash, gift cards, gift certificates, or other property)** given has a value of $100.00 or more, the recipient must also provide his/her Social Security Number (SSN) or Individual Taxpayer Identification Number (ITIN) and permanent address for the purpose of 1099-MISC reporting. A signature is required, even if the amount is less than $100.00.

1. I, _____, have received ☐ **OR** am requesting ☐ compensation in the form
   (Printed Name)
   and amount indicated below:
   - Cash $_____
   - Gift Certificate/Gift Card $_____
   - Other Property $_____ Description_____

2. Are you an Iowa State University Employee? ☐ Yes ☐ No

3. Record **either** your Social Security Number **or** your Individual Taxpayer Identification Number.
   (This information is required only if the property given has a value of $100.00 or more.)
   __ __ __ - __ __ - __ __ __ __ **OR** __ __ __ - __ __ - __ __ __ __
   Social Security Number or Individual Taxpayer Identification Number

   Federal and state law protects the privacy and security of your SSN or ITIN, and ISU will not disclose your SSN or ITIN without your consent for any other purposes except as allowed by law. A Form 1099-MISC will not be submitted to the IRS unless all payments received from ISU in a calendar year are $600 or more.

4. Record your complete permanent address.
   (This information is required only if the property given has a value of $100.00 or more.)

   _____ _____ Address
   City State ZIP Code

5. Signature and Date *(These are required, regardless of the amount.)*

   _____ ___/___/___
   (Signature) MM/DD/YYYY

   Your signature certifies that you are not subject to backup withholding due to failure to report interest and dividend income. It also certifies that you are a U.S. person, including a U.S. resident alien. If you are not a U.S. person, you must complete and attach IRS Form 8233 to obtain exemption from 30% backup withholding

TO ISU PERSONNEL:
This form provides documentation for cash, gift certificates, gift cards, or other property given by ISU. If the property was purchased by an ISU Purchasing Card, keep the original form as part of your Purchasing Card documentation. If the amount is $100.00 or more, **forward a copy of this form to Matt Devick, Accounting Office, 1520 ASB** to meet IRS reporting requirements. Please provide the Worktag, date, and Workday reference number, so that we can link the Property Receipt Form to a specific expenditure.

If clearing petty cash, attach the Property Receipt Form to a Journal Entry in Workday.

If documenting expenses for a reimbursement, attach the Property Receipt Form to the Expense Report in Workday.

CHAPTER 6. GENERAL CONCLUSION

Summary

Understanding why youth enter hazardous situations and end up entrapped or engulfed in grain was the primary goal of the research. The purpose of this study was to analyze how certain factors affected the decision-making of youth who choose to enter agricultural grain storage facilities. The factors were personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. The following objectives were accomplished to complete this study:

1. Identify the reasoning for youth grain bin entry.
2. Utilize a scenario-based survey instrument and qualitative interviews to determine which course of action participants would take if presented with real grain bin-related situations.
3. Determine which factors contributed to participants' decision-making in each scenario.
4. Analyze the demographic differences in participant responses.

The study used a multi-stage mixed-methods approach, which followed an explanatory sequential process (Creswell, 2012). First, a web-based survey instrument was designed via Qualtrics®^{XM}. The instrument included three scenarios related to grain storage and handling tasks. Respondents were instructed to choose a course of action of what they would do next if presented with the scenario in real life. Subsequently, respondents ranked the relevant factors in their decision-making process for each scenario from the most important to the least important. The instrument asked why respondents were working inside grain bins as a youth and collected general demographic data such as gender, age, home state, and academic major. The survey also asked if the individual had ever been entrapped or engulfed in grain while under 18. Finally, the

survey collected contact information of participants who were willing to complete a follow-up interview.

The survey instrument was validated by agricultural safety and health professionals. Once content validity was achieved, the instrument was pilot tested by several Iowa State University student organizations. Both parties provided recommendations for question clarity and instructions for how to answer the questions. The researcher adjusted the survey based on feedback, and the survey instrument was ready for distribution.

The survey was administered to Iowa State University students enrolled in selected academic departments (N = 2,687). To qualify for the study, students self-disclosed having grain bin experience while under 18 years old. Upon completing the survey, respondents could indicate their interest in participating in a short follow-up interview with the researcher. Fifty-three participants stated their interest. To select participants to interview, the researcher administered an interviewee selection criteria survey. Interested participants revealed their level of involvement with their farming operations and experience with grain bins as youth. Participants also indicated how often they were supervised by their parents while completing farm work and how often they worked with peers or siblings on the farm.

Ten interviewees were selected based on their levels of farm involvement, experience with grain bins, and amount of parental supervision. Semi-structured interviews were conducted virtually using WebEx™ video conferencing software and were audio-recorded for transcription purposes. Interviewees were asked about their reactions to the survey results and their own experiences working inside grain bins and under their parents' supervision. As compensation, all interviewees were awarded a gift card upon completion of the interview.

The quantitative survey data were analyzed using IBM SPSS® (version 27). Descriptive statistics were used to describe the study's population, and inferential statistics were used to determine differences among demographic groups. The audio-recorded qualitative interviews were transcribed and coded by hand using Microsoft® Word. Several themes emerged from the data and were used to supplement the quantitative findings.

Major Findings

Quantitative

There were 229 responses to the survey – 206 met the criterion of having grain bin experience while under 18 years old and 169 finished the survey. Most respondents were males and had a median age of 20 years. The Midwestern states were most represented, as participants were predominantly from Iowa, Illinois, Wisconsin, and Minnesota. Most respondents had an academic major in Agricultural Business, Agronomy, Animal Science, Agricultural Studies, or Agricultural Systems Technology.

One student disclosed that they had been entrapped in grain as a youth. The incident occurred in 2006 when the individual was 11 years old. According to the participant, they were, "Cleaning a bin and following [the] sweep and was wrapped in [the] auger." The participant stated that the local fire department came to the farm to remove them from the grain bin, and they were later flown to the area hospital for treatment.

The study's first objective was to identify the reasoning for youth grain bin entry. Based on participant survey responses, the most common reasons for entry were cleaning or removing grain from the grain bin, conducting repairs or maintenance, playing inside the grain bin, or checking the grain level, condition, or moisture. Leveling the grain and grain bin assembly or disassembly was also reported.

The first scenario analyzed personal safety versus parental authority and pressure. Most respondents to Scenario #1 chose the safe option to, “Use a pole to break up the blockage from outside the bin.” The next most popular answer was to confront the parent and tell them that it is dangerous to enter the bin in this situation. There was a slight difference between genders in answering this scenario, as more males chose to enter the grain bin. However, this difference was not significant.

Scenario #2 examined personal safety versus productivity. Most respondents chose an option to wait for the grain to unload, although approximately one-fifth of respondents chose to enter the bin. There was a significant difference in the way males answered Scenario #2 versus females, as many more males reported that they would enter the bin. Females more often reported that they would wait and check the progress of the unload.

The final scenario studied personal safety versus sibling and peer pressure. Most participants reported that they would, “Communicate the possibility of avalanched grain” to their sibling. Almost one-fifth of participants chose to enter the grain bin in this situation. Like Scenario #2, there was a significant difference in the way males and females responded to Scenario #3. More males would enter the bin, while females would communicate the possibility of avalanched grain to their sibling.

Based on results from chi square tests of independence and the standardized adjusted residual analysis, associations between variables emerged. There was a strong association between males and entry into grain bins, whereas females were more likely to communicate or patiently wait. The younger population was more likely to choose options that were productive but did not require them to enter the grain bin. There is some evidence of the older population communicating with others. Iowa-residents had strong associations with using a pole to break up

the blockage, patiently waiting, or communicating with siblings. Lastly, academic major had some associations with scenario options. The results showed associations with Agricultural Business students entering the bin to remove the blockage. Agricultural and Biosystems Engineering students would use a pole to break up the blockage. Agricultural Studies majors were strongly associated with choosing to wait, while Animal Science students would communicate with their siblings. Agronomy students chose to beat on the outside of the bin.

In all three scenarios, personal safety was most often regarded as the factor contributing to the highest importance of how participants responded to the scenarios. Using a statistical analysis adopted by Keren et al. (2006), the factor of personal safety was significantly held in higher importance than other factors for all three scenarios. In Scenario #1, parental authority and pressure was significantly held of lower importance than all other factors, and in Scenario #3, sibling and peer pressure was also significantly held of lower importance.

The one-sample t-test analysis complemented these findings. Personal safety yielded a p-value of less than .001 for all three scenarios, indicating its significance in how respondents answered the scenarios. Scenario #1's other significant factors were productivity and parental authority and pressure. Scenario #2 yielded significant results for likelihood of engulfment, and Scenario #3 found the hazard level of the task and sibling and peer pressure significant in respondents' decision-making.

Qualitative

The first research question asked why youth choose to make hazardous decisions regarding grain storage facilities. In the interviews, participants revealed common barriers to remaining safe on the farm. Most frequently reported were time and weather, lack of manpower, cost, and a false sense of security. Participants also specified their sources of where they learned their agricultural safety knowledge, or lack thereof. Parents, specifically fathers, were credited

with being participants' primary teachers of farm safety. Organized Farm Safety Days, traumatic stories of farm incidents, personal experiences from growing up on the farm, and common sense were other reported knowledge sources.

The second research question inquired about the role of parental supervision in youth safety-related decisions on the family farm. Respondents mentioned the complicated parent-child supervisor-employee relationship on the farm. Participants indicated that they trusted their parents and that their parents would not ask them to do any tasks that their parents themselves would not do. Many participants were adamant that it is the parents' job to be looking out for their youths' safety. There was a balance between respondents who would openly refuse their parents' orders if the task was unsafe, and respondents who would typically follow any order that their parent gave them. Although, some interviewees contradicted themselves about this fact, it was a common consensus that respondents' parents had never asked them to do anything unsafe.

The final research question asked about the factors which played a role in youths' decision-making. Personal safety was unanimously held in the highest regard among all interview participants. Participants pointed to the need for productivity during stressful times, such as planting and harvest seasons, but productivity was never more important than personal safety. Participants were well aware of potential grain engulfment scenarios and used the likelihood of engulfment to select answers to the scenario survey questions. The hazard level of the task, according to participants, was heightened when working alone, working with other youth, or working inside a bin with poor quality grain. Participants revealed that they did not feel pressured to do any farm task by their parents. Yet, there was a split response among participants who would follow any order versus those who would openly rebel dangerous orders. Lastly, participants indicated that sibling authority is not as strong as parental authority, and the sibling's

age had a significant impact on the pressure felt. One interviewee even declared that youth who grow up on farms are typically not affected by peer pressure in any situation.

Conclusions

Several remarkable conclusions can be drawn from this study. First, based on the participants' scenario choices, their ranking of the decision-making factors, and dialogue from the interviews, participants were aware of the farm hazards discussed in this study. All interviewees showed a general knowledge of grain entrapment and engulfment and knew of risk factors that may warn a farm worker that entrapment or engulfment may be likely. Not only did participants know about grain storage facility hazards, but they also mentioned other, more general farm hazards. The danger of working alone was a common topic of discussion, as well as not taking extra time to think of personal safety during planting, harvest, or when incumbent weather is moving in. Several participants also mentioned the false sense of security that some farmers and farm workers feel as if an incident "won't happen to them." Based on the findings, participant awareness of the hazards is apparent.

When asked to rank the factors affecting participants' decision-making from most important to least important, personal safety was consistently ranked the highest. In the survey, most participants did choose a "safe" option when answering the scenarios, even if it was to wait a few minutes and then reassess the situation. Interviewee participants were quoted saying that personal safety has to come first and that farmers cannot be productive if they are injured due to disregarding their safety. Therefore, it can be concluded that in this study, participants claimed to value their safety.

It has already been determined that participants know the hazards and value their personal safety, yet some participants still chose a hazardous scenario option. Each scenario offered an option to enter the grain bin, and in all three scenarios, this was considered an unsafe

option. Based on the ranking of the factors, parental authority and pressure and sibling and peer pressure were of low importance in participants' decision-making. Likewise, productivity was held in low regard. However, productivity is one of the only logical reasons that participants would still choose to enter the grain bin despite knowing the hazards. Another possibility would be the participants' false sense of security or the feeling that an incident would not happen to them. Overall, it is questionable why even though participants reported that they knew the hazards and valued their safety, some participants continued to choose unsafe options.

In agricultural grain production, many tasks are completed around the emphasis of time. Planting and harvesting, hauling grain to uphold contracts, and purchasing inputs for the following year can be time-sensitive and require high productivity levels. However, this study's findings indicated that productivity was not of high importance. This was evidenced by the way most participants answered the scenario questions and how they failed to prioritize productivity while ranking their decision-making factors. Many participants chose options equivalent to waiting several minutes and reassessing the situation or waiting indefinitely and allowing the task to take as long as it would without human interference. Although time is considered vital in real-world production agriculture, participants in this study did not treat it as such.

Gendered differences also played a role in youth safety-related decisions. In Scenarios #2 and #3, there was a significant difference between males' and females' decision-making. In both scenarios, males were more inclined to partake in higher-risk actions, like entering the grain bin, than females. Females were more likely to wait until they were forced to act or choose an alternative option that might not be quite as productive. Per the adjusted standardized residual analysis, there was a strong association with males and grain bin entry for all three scenarios.

Entry into the bin was an unsafe choice. The findings concur with previous research that determined females are more risk-averse than males (Killgore et al., 2010).

There is some association with certain demographic factors and the risk-taking propensity evaluated through the scenario questions. Specific academic majors were more apt to engage in potentially risky choices, whereas other majors tended to patiently wait or communicate with others. The same is true when analyzing Iowa versus non-Iowa residents and different age groups of participants. While this study only began to evaluate the connections between personal characteristics and risk-taking propensity, perhaps certain demographic data could help predict the youth's likelihood of engaging in hazardous farm tasks.

Per the Hazardous Occupations Orders for Agriculture exemption, youth can complete tasks within grain storage facilities on their family farms while under 16 years old. Participants in this study reported a plethora of reasons why they were inside grain bins as a youth, and most were legitimate reasons for entry. Cleaning and removing grain from the bin and conducting repairs and maintenance were the two most commonly reported tasks. However, the third most commonly reported reason for entry, representing nearly one-fifth of the total responses to this item, was playing inside the grain bin. Regardless if the bin is empty or full of grain, it is not advised that youth play inside grain bins. Entry into grain bins should only occur when necessary, and even under adult supervision, youth should not enter grain bins unless they are helping an adult complete a task. Before assisting, youth should be briefed on the potential safety hazards of working inside and around grain bins and know how to shut off moving parts if something were to go awry.

When asked where they learned most of their agricultural safety knowledge, all ten interviewees stated their parents, specifically their fathers, taught them. Some participants shared

personal stories about how their parents briefed them about all the dangers that could happen before beginning a new farm task. One story was shared about preparing to remove grain from a bin by placing a sweep auger inside, but some stories related to working with power take-offs or cow-calf pairs. One interviewee mentioned how his father said that he should never be afraid of anything that he does on the farm, but he should always respect what could happen. The farm safety knowledge learned right on the farm from parents was deemed the most prevalent and impactful.

In addition to learning directly from parents, interviewees also credited Farm Safety Days sponsored by their school, FFA chapter, or 4-H club for teaching them about farm safety. Interviewees shared how they attended either one or multiple of these events as youth. Some participants even had experiences volunteering at Farm Safety Day events once they entered high school and helped teach the younger students about specific agricultural safety topics. The Farm Safety Days made an impact on participant knowledge and learning retention, as one participant could recall a grain entrapment demonstration that he had watched when he was in grade school.

Of the ten participants interviewed, several declared that it is a parent's job to keep their children safe on the farm. The interviewees acknowledged genuine trust in their parents and claimed that their parents would not ask them to do anything unsafe or unreasonable. When recalling past experiences, no interviewee could recall a time when their parents had asked them to do a farm task that they were uncomfortable with, and especially not regarding tasks related to grain bin entry. However, it should be noted that some participants stated that if their parents did ask them to do something unsafe, they would have no problem telling their parents "no." The claims complement the survey findings that participants regard personal safety higher than

parental authority and pressure. The same is true when analyzing personal safety versus sibling and peer pressure.

The following points highlight the study's general conclusions:

- The hazards of grain entrapment and engulfment are well known by youth.
- Youth value their safety while working.
- Although aware of the hazards and claiming to value personal safety, youth may still choose to make hazardous decisions.
- Productivity is valued by youth in agriculture, but not more than personal safety.
- Gender, age, home state, and academic major affects youths' risk-taking propensity of safety-related decisions.
- Youth are working inside grain bins, but they are also playing inside grain bins.
- Youth learn most of their agricultural safety knowledge from their parents.
- Youth trust that their parents would not ask them to do any unsafe tasks on the farm.
- Youth would refuse their parent's orders if they thought the task was unsafe.

Recommendations

The following are recommendations based on the findings from this study:

1. Parents must assume the "safety instructor" role on their family farms. Therefore, increase the educational and outreach materials targeted at parents. Provide parents with recommendations for teaching their children about farm safety and how to assign age-appropriate farm tasks.
2. Increase farm parents' awareness of the risk-taking propensity of their sons versus their daughters. Parental supervision efforts may be adjusted based on which child helps

parents complete farm tasks more often. However, explicit orders and safety briefs must be given to both genders.

3. Intensify training efforts concerning safe decision-making. The findings show that individuals know the hazards and value their personal safety, yet they continue to make hazardous decisions. Training modules about smart decision-making despite productivity or supervisory pressures should be administered.
4. Encourage Farm Safety Day events at rural schools. Although parents were credited as the primary source of agricultural safety knowledge, Farm Safety Days were also commonly mentioned. The hands-on, experiential learning activities impacted participants, as interviewees could recall specific Farm Safety Day demonstrations from over a decade ago.
5. Intensify educational programming and awareness of parents about the dangers of youth playing inside grain bins. Nearly 18% of participants in this study reported playing inside a grain bin while under 18 years old. Encourage farm parents to terminate the use of grain bins as a play space for their children, and instead promote designated Safe Play areas.
6. Increase farm parent awareness of the trust that their youth have in them. Some of this study's participants would openly refuse unreasonable orders from their parents. However, other participants reported that they would follow their parents' orders because they believe that their parents would not ask them to do anything unsafe. Farm parents must be aware of this fact and only assign their youth tasks that are age-appropriate and relatively safe.

Further Research

Youth decision-making in agricultural scenarios is a relatively new subject area. The following are recommendations for future research based on the findings of this study:

1. Participants in this study were aware of grain entrapment and engulfment hazards. Participants also pointed to additional hazards such as working alone, working without an adult, and rushing during certain time-sensitive seasons. Participants claimed to hold their personal safety in high regard. Even so, grain entrapment and engulfment cases involving youth in agriculture continue to occur. More research should be conducted on two suggestive factors: the need for productivity and the false sense of security.
2. This study found preliminary data on youth risk-taking propensity. Respondents of both genders, different age groups, from various locations, and enrolled in differing academic majors had some associations with specific scenario options. Further research should be conducted to analyze how demographic data could help predict the youth's likelihood of engaging in hazardous farm tasks.
3. This study researched three scenarios within the same general realm of grain storage and handling. The study was also conducted at one university within the Midwestern United States and cannot be adequately generalized to a greater population. Additional research following the same methodology should be conducted using various farm hazard scenarios, for example, involving tractor operation or livestock handling. The research should cast a wider pool of participants to sample so the results can be better generalized.
4. This study utilized a convenience sample of students within one Midwestern land-grant institution. Students had to recall past experiences from when they were under 18 years old to participate. In the future, research should target this youth population directly for the study instead of relying on older participants' memories from when they were under 18 years old. Targeting this population directly may impact the truthfulness and accuracy of respondents' answers.

Implications

Several implications can be drawn from this study based on the research questions asked. The first research question analyzed why youth choose to make hazardous decisions regarding grain storage facilities. Based on the study's findings, factors such as time and weather, lack of manpower, a false sense of security, and the cost of implementing safety controls were general barriers to remaining safe on the farm. Although some of these factors are out of an individual's control, they can try to only work while another individual is present and acknowledge that a farm incident can happen to anyone regardless of the individual's experience level. Any farmer or farm worker must respect what could happen as they are completing farm tasks.

This study found that gender played a role in the risk-taking tendencies of participants. The recognition that females are naturally more risk-averse than males is integral in protecting all workers from farm hazards. One of the leading populations of grain entrapment and engulfment victims is young boys (Cheng et al., 2019). Although this population is likely more involved in grain handling tasks than other youth populations, young boys' risk-taking propensity may also play a role in the youth grain entrapment and engulfment data.

The second research question examined the role of parental supervision in youth safety-related decisions on the family farm. As noted from the interviews, participants most often credited their parents for teaching them about agricultural safety. Therefore, parents must serve as their children's "agriculture safety instructor" before wishing to involve them in farm work. Safety is a learned behavior, although many farm parents equate safety knowledge with common sense (Summers et al., 2017). Parents must engage in safety-related conversations with their youth and normalize talking about the potential dangers. It is known that when supervisors are explicit about following safety rules in the workplace, the workers are less likely to take risks

(Westaby & Lowe, 2005). The same may be true for farm parents supervising their youth – setting clear safety rules and expectations could help prevent farm youth injuries.

As suggested from the interviews, parents briefing their youth on any hazards that could occur before completing a task is a viable option to ensure that the youth is prepared for any potential mishaps. Additionally, when youth hear stories about traumatic injuries or fatalities in agriculture, they can better understand why they must take certain safety precautions. Finally, parents practicing noble safety behaviors is imperative for youth safety. Because youth often imitate their elders' behaviors, primarily their fathers, they must have a role model who practices safe farm behaviors to emulate (Jinnah & Stoneman, 2016).

The final research question analyzed the factors that affected youths' decision-making. The factors were personal safety, productivity, hazard level of the task, likelihood of engulfment, parental authority and pressure, and sibling and peer pressure. From both the survey and interview results, it is evident that participants in this study valued their personal safety over other factors, which matched the findings of Mosher et al. (2014).

Finally, participants were highly aware of grain entrapment and engulfment hazards. Because self-preservation was held in such high regard, and participants were well aware of the hazards, it is questionable why grain entrapment and engulfment incidents continue to occur. Undoubtedly, the factor of productivity plays a role, although the data suggest that participants did not hold the factor in high importance. The findings of this study, while profound, undoubtedly point toward the need for supplementary research.

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